McGraw-Hill
Industrial Management
Series

100000

NEWTON BLICKMAN
126 WESTBOURNE LANE

Digitized by the Internet Archive
in 2026

https://archive.org/details/industrialaccoun0000john

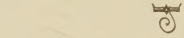
McGRAW-HILL INDUSTRIAL MANAGEMENT SERIES

DEXTER S. KIMBALL, Consulting Editor

Dean, College of Engineering, Cornell University

INDUSTRIAL ACCOUNTING FOR EXECUTIVES

McGRAW-HILL
INDUSTRIAL MANAGEMENT SERIES
DEXTER S. KIMBALL, Consulting Editor



Bangs—Industrial Accounting for Executives
Barnes—Industrial Engineering and Management
Harriman—Principles of Scientific Purchasing
Harriman—Standards and Standardization
Holmes—Plant Location
Kimball—Industrial Economics
Kimball—Principles of Industrial Organization
Lowry, Maynard and Stegemerten—Time and Motion Study
Tournier—Materials Handling Equipment

INDUSTRIAL ACCOUNTING FOR EXECUTIVES

BY

JOHN R. BANGS, JR.

Professor of Industrial Engineering, Director of Engineering Personnel and Placement, College of Engineering, Cornell University; Author of "Factory Management"

FIRST EDITION
THIRD IMPRESSION

McGRAW-HILL BOOK COMPANY, INC.
NEW YORK AND LONDON
1930

COPYRIGHT, 1930, BY THE
McGRAW-HILL BOOK COMPANY, INC.

PRINTED IN THE UNITED STATES OF AMERICA

THE MAPLE PRESS COMPANY, YORK, PA.

PREFACE

As the work of the engineer has become more industrial, his knowledge of accounting has repeatedly been challenged. Time and again the problems of production, time study, wage-incentive plans, and factory costs have required of him a knowledge of accounting. In many cases this knowledge has been sadly lacking.

This textbook is an attempt to use the naturally analytical powers of the engineer in solving the industrial and accounting problems normally encountered in rising to the position of industrial executive.

Simplicity has been stressed throughout, and much of the work has been built upon a diagrammatic ledger plan, a scheme which enables the student to get an overall picture of his problem on one page. This scheme is well developed in Woodbridge's "Elements of Accounting" and Kohler and Morrison's "Principles of Accounting," and due acknowledgment is made at this point of the help received from these standard texts. That the diagrammatic ledger plan is of practical value is proved by its marked success in the teaching of accounting to engineers in the Sibley School of Mechanical Engineering, Cornell University. This textbook has in fact, grown from the mimeograph notes from which this course has been taught for three years.

No attempt at originality has been made. The author is an industrial engineer who has had the opportunity of working in a number of our large industries and of making a study of their cost and accounting systems. From such experience and from a comprehensive study of the subject of accounting, this text has been evolved.

The first twelve chapters are devoted to the background and mechanisms of accounting. Chapters XIII to XXI deal with industrial and cost accounting. Here again the diagrammatic form, because of its simplicity of presentation and because it is the language of the engineer, has been specifically stressed.

The writer has availed himself of the mass of information compiled by the accounting profession and has endeavored to

give full credit for all material used. He is particularly grateful to Dean D. S. Kimball of the College of Engineering, Cornell University, for his kindly cooperation in enabling him to found an accounting course in the engineering school and also for his helpful criticism of the text material. Further help in the teaching and compiling of problems is gratefully acknowledged to Prof. M. A. Lee, Messrs. H. F. Kneen, F. P. Kneen, F. T. Rhodes, L. C. Lay, W. A. Hunt, and Miss Clara Zeigler. Professor Lee has read the entire manuscript and made many valuable criticisms and suggestions. Professional industrial accountants, including Messrs. A. Matey, J. H. Scott, A. J. Carlson, and C. Janda, have also aided greatly in the preparation of this text.

The author will be thankful for suggestions or criticisms that will make the book more useful, or for corrections that will make it more accurate.

JOHN R. BANGS, JR.

ITHACA, N. Y.
January, 1930.

CONTENTS

PAGE

PREFACE v

LIST OF ILLUSTRATIONS xiii

INTRODUCTION 1

PART I

CHAPTER I

FUNDAMENTAL ELEMENTS OF ACCOUNTING 8

Assets = Liabilities + Capital, A Fundamental Expression—Technique of Proprietorship Equation—Elements of the Balance Sheet of a Manufacturing Company—Classification of Assets—Liabilities—New Worth—Classification of New Worth—The Complete Balance Sheet—Form of the Balance Sheet—Balance Sheet Problem and Solution.

CHAPTER II

THE ACCOUNTING TRANSACTION 15

The Account—Its Definition and Technique—Procedure for Making Entries to T Accounts—Problem and Solution to Illustrate Use of T Accounts—A Diagram of the Ledger of the "Diagrammatic Ledger Plan"—Analysis of Mixed Transactions.

CHAPTER III

SALES, PURCHASES AND THE COST OF GOODS SOLD 25

Old and New Ways of Handling Merchandise Entries—Problem and Solution to Illustrate Sales and Purchases—Cost of Goods Sold—Problems and Solutions to Illustrate Cost of Goods Sold—Profit and Loss Account and the Profit and Loss Statement.

CHAPTER IV

INTRODUCTION TO THE BASIC BOOKS OF ACCOUNTING JOURNAL AND LEDGER 32

The Journal and Ledger—Journal and Ledger Rulings—The Trial Balance—Practical Instructions from Industry—Problem and Solution to Illustrate Bookkeeping Procedure.

CHAPTER V

ACCOUNT CLASSIFICATION 48

Major Divisions of Accounts—Current and Fixed Assets—Deferred Assets or Prepaid Charges—Intangible Assets—Current and Fixed

PAGE

Liabilities—Account Classification of a Manufacturing Plant—Classification of Indirect Manufacturing Expense—C.P.A. Classification Problem and Solution.

CHAPTER VI

PROCEDURE OF THE END OF THE FISCAL PERIOD—ADJUSTING ENTRIES 62
The Work Sheet and Its Purpose—Problem and Solution to Illustrate Use of the Work Sheet—Comparison of One Accounting Period with Another—Prepaid Insurance—Deferred Interest Income—Seven Types of Adjustment Entries—Merchandise Inventory Adjustment to Find the Cost of Goods Sold—Deferred Expense Such as Prepaid Insurance—Deferred Income Such as Interest Received but Not Yet Earned—Accrued Expense Items Such as Accrued Payroll—Accrued Income Such as Accrued Interest—Reserve for Depreciation—Reserve for Loss on Accounts Receivable—Bad Debts—Complete Work Sheet Problem and Solution.

CHAPTER VII

PROCEDURE AT END OF FISCAL PERIOD—CLOSING THE BOOKS . . . 89
Order of Procedure—Transferring Figures to the Books: Adjusting Entries—Use of Red Ink—Complete Accounting Problem and Solution.

CHAPTER VIII

METHODS TO INSURE DIVISION OF LABOR 115
The Need of Specialization—The Sales Journal—Sales Journal Problem and Solution—The Purchase Journal—Purchase Journal Problem and Solution—The Cash Book (Journal)—Cash Book Problem and Diagrammatic Solution—The General Journal—Problems in Posting When Special Books Are Used—Complete Cash Book Problem and Solution—Problem and Solution to Illustrate Handling of Mixed Transactions.

CHAPTER IX

PROCEDURE OF ACCOUNTING FOR CASH, PETTY CASH, TRADE DISCOUNTS, AND CASH DISCOUNTS 135
Checking Cash by the "Double-Record" Method—Petty Cash: The Imprest System—Petty Cash Problem and Diagrammatic Solution—Internal Check—Trade Discounts—Cash Discounts—Purchase Discounts.

CHAPTER X

CONTROLLING ACCOUNTS 142
Subdivisions of the Ledger—Definition of a Controlling Account—Principal Kinds of Controlling Accounts—Self-balancing Ledger—Extension of Self-balancing Ledger Principle—The Private Ledger

PAGE

—Effect of Controlling Accounts on Books of Original Entry—Controlling Account Problems and Solutions

CHAPTER XI

THE VOUCHER SYSTEM 156
Need of a New Type of Record—Evolution of the Voucher System—Procedure under the Voucher System—Voucher Register Problem and Solution—Elimination of the Creditors' Ledger—Cash Discounts on Purchases—Returns and Allowances on Purchases—Extension of Voucher Principle.

CHAPTER XII

THE EXTENSION OF PROPRIETORSHIP FROM THE SINGLE PROPRIETORSHIP TO THE PARTNERSHIP AND THE CORPORATION. 163
Diagrammatic Ledger of Single Proprietorship, Partnership and Corporation—Three Outstanding Forms of Business Organization—Sole Proprietorship or Individual Ownership—The Partnership—The Corporaton—Treasury Stock—Authorized Stock—Market Value—Book Value—Real Value—Par Value—No Par Value—Effect of Type of Organization upon the Balance Sheet—Important Points of Difference—Necessity of a Surplus Account—Books of Corporate Record—Partnership Problems and Solutions—Admission of New Pa tners—Partnership Dissolution—Corporation Problems—Two Types of Opening Entries—Changing from a Partnership to a Corporation—Problem and Solution—Typical Problem of Incorporation—Problems and Solutions—Treasury Stock Donated—Problem and Solution—Further Corporate Problems and Solutions—References for Part I.

INTRODUCTION TO PART II 198

PART II

CHAPTER XIII

ACCOUNTS AND STATEMENTS OF A MANUFACTURING BUSINESS. . . . 209
General Classes of Manufacturing Industries—The Effect of Continuous and Intermittent Industries upon the Cost System—Process Costs—Problem and Diagrammatic Solution—Fundamentals of Process-cost Systems—Order Costs—Statements and Accounts of a Manufacturing Business—Definitions—Overall Picture of Factory Accounts—Review of Fundamental Principles and Their Extension to Manufacturing—Problems and Solutions—Effect upon the Statements—Underabsorbed and Overabsorbed Factory Expense—Underabsorbed and Overabsorbed Administration and Selling Expenses—Three Ways of Keeping Factory Accounts—Problems and Solutions—Diagrammatic Plan versus the Work Sheet Method.

CHAPTER XIV

PAGE

METHODS OF DISTRIBUTING FACTORY EXPENSE 243

Different Methods Used in Distributing Factory Expense—Distribution on the Basis of Direct Material—Distribution on the Basis of Direct Labor—Distribution on the Basis of Man-Hours—Distribution on the Basis of Machine Rate—Inadequacy of Direct-labor and Man-hour Method of Distributing Expense in a Machine Shop with a Varied line of Machinery—Details of the Machine-rate Method of Distributing Expense—How to Use Machine Rates—Normal Operation—Underabsorbed and Overabsorbed Factory Expense—Factory Expense—A Normal Year—The Business Standard—Concrete Illustrations of Underabsorbed and Overabsorbed Factory Expense—Problem and Solution—Loss Due to Idle Plant Capacity—Problem and Solution—The Economic Effect of Taking Business at or below Cost.

CHAPTER XV

FINANCIAL MATHEMATICS OR ACTUARIAL SCIENCE 276

Four Fundamentals Underlying Majority of Financial Calculations—Algebraic Expressions of the Four Fundamental Problems—Diagrams and Solutions—Sinking Funds—Problems, Diagrams and Solutions—Amortization of Interest-bearing Indebtedness—Problems, Diagrams and Solutions—Comparison of Sinking Fund and Amortization Plans—Problems and Solutions—Bond Valuation—Problems, Diagram and Solutions—Shorter Method of Bond Valuation—Compound Interest Tables.

CHAPTER XVI

DEPRECIATION, OBSOLESCENCE, INADEQUACY, AND DEPLETION 307

Two Fundamental Problems—Depreciation a Cost Element—Methods of Calculating Depreciation—Most Widely Used Methods of Depreciation—Advantages and Disadvantages of Different Methods—Depreciation Schedules—Problem, Solution—Depreciation Curves—Recording Depreciation—Additions and Repairs Usually Charged to Expense—Guards against Misconceptions Concerning Depreciation—Effect of Obsolescence and Inadequacy—When Shall an Old Machine Be Scrapped and a New One Purchased?—Problems and Solutions—Depletion—Valuation of Mines, Timberland, etc.—Algebraic Expression for Present Value of a Wasting Asset—Problems and Solutions—U. S. Treasury Table for Determining Value of Wasting Assets—Problems and Solutions—Consideration of Depreciation, Obsolescence, and Depletion with Reference to Income Tax—Problems and Solutions.

CHAPTER XVII

STANDARD COSTS. 337

General—Difficulties of the Order-cost System—Establishing Standards—Standard or Bulletin Cost—Use of Standard Costs—

PAGE

Application of the Standard Cost System—Material—Labor—Factory Expense—Summary of Costs at the End of the Month—Advantages of Standard Costs—Three Typical Plans of Standard Costs Outlined by the Department of Manufacture of the United States—Diagrams and Solutions—Practical Illustrations of Standard Costs—Bedaux Method of Labor Measurement—Probiems and Solutions—Standard Cost Applied to a Shop-accounting System—Illustration of Shop-accounting System—Further Diagrammatic Standard Cost Plans.

CHAPTER XVIII

BUDGETARY CONTROL 377

The Budget System a Coordinated Plan of Control—Budgetary Control of Factory Expense—Constant and Variable Expense—Method of Setting a Budget—Problem and Solution—Estimated Statements—Reports of Budget Realization—Advantages to Be Derived from Budgetary Control.

CHAPTER XIX

ANALYSIS OF FINANCIAL STATEMENTS 387

Balance Sheet Analysis—Application of Ratios—Problem and Solution—Procedure for Analyzing a Single Balance Sheet—Analyzing Two or More Balance Sheets of the Same Company—Trend Percentage Method—Procedure for Analyzing Two or More Balance Sheets of the Company—Standard Ratios—Ideal Ratios—Profit and Loss Statement Analysis—Trend Percentage Method Applied to Income and Expense Statements—Procedure for Analyzing a Series of Profit and Loss Statements.

CHAPTER XX

CONTROVERSIAL AND DEBATABLE ACCOUNTING SUBJECTS 404

Interest on Investment a Debated Point—Reason for the Inclusion of Interest as a "Cost"—Material Handling Formulæ of A.S.M.E.—Application of Formulæ—Pros and Cons of Interest Inclusions—Objections and Answers Concerning Interest Inclusion—Handling Purchases Discounts—Handling Sales Discounts—Determination of Normal Distribution Rates—Replacement Value in Determining Depreciation.

CHAPTER XXI

MODERN MECHANICAL METHODS OF PERFORMING THE ACCOUNTING FUNCTION 418

Accounting Principles and Accounting Machines—Classification of Bookkeeping Machines—Illustration of the Use of Accounting Machines—Remington Bookkeeping Machine—Burroughs Machines—Elliott Fisher Machines—Tabulating, Accounting, and Analysis Machines—References.

INDEX 443

LIST OF ILLUSTRATIONS

PAGE

1. Diagram of Accounting Procedure 5
2. The Business Stream Illustrating the Balance Sheet and Profit and Loss Statement 6
3. Diagrammatic Ledger Illustrating Operation of T Accounts . . . 21
4. Diagrammatic Ledger 28
5. Diagrammatic Ledger to Illustrate Cost of Goods Sold 28
6. Diagrammatic Ledger to Illustrate Cost of Goods Sold 30
7. Procedure Diagram for Journalizing and Posting 32
8. Printed Form for Journal Entry 38
9*a*, *b*. Industrial Trial Balance 40, 41
10. Diagram of Account Classification 49
11. Solution to Work Sheet Problem 63
11*a*. Solution to Complete Work Sheet Problem 85
12. Procedure for Closing the Books 90
13. Diagram for Handling Sales 116
14. Diagram for Handling Purchases 120
15. Diagrammatic Solution for Mixed Transactions 132, 133
16. The Double Record Principle 136
17. Operation of Petty Cash, Imprest System 138
18*a*, *b*. Diagrams to Illustrate Controlling Accounts 143
19. Subsidiary Ledgers 144
20. Diagrammatic Solution to Illustrate Accounts Receivable and Accounts Payable Controls 145
21. Self-balancing Control Accounts 147
22. The Factory Ledger and Its Controls 148
23. The Private Ledger 151
24. Four Column Self-balancing Cash Book 151
25. Solution to Cash Book Problem Using Controlling Accounts . . . 152
26. Complete Controlling Account Problem 155
27. The Voucher Check 157
28. Solution to Voucher Register Problem 160
29. Diagram to Illustrate Range and Complexity of Systems 198
30. Procedure for Purchasing and Receiving Raw Materials 199
31. Procedure for Issuing Raw Materials from Stores 200
32. Procedure for Handling Direct and Indirect Labor 201
33. Procedure for Predetermining and Distributing Expense 202
34. Diagram of Manufacturing Procedure 204
35. Development of Manufacturing Orders 206
36. Diagram of Process Costs 211
37. Solution to Process Costs Problem 213
38. Elements of Manufacturing Costs 215
39. Overall Picture of Factory Accounting Procedure 218

PAGE
40. Diagrammatic Solution to Factory Problem 223
41. Combined Factory and General Ledger 228
42. Separate Factory and General Ledger 230
43. Diagrammatic Solution to Factory Problem 231
44. Diagrammatic Solution to Factory Problem 237
45 to 48. Forms to Illustrate Compilation of Machine Rate . . . 250–254
49. A Page of a Machine Rate Book 258, 259
50. Diagram to Illustrate Underabsorbed and Overabsorbed Factory Expense 262
51. The Amount of $1 for "n" Periods at "i" Rate of Interest . . . 277
52. The Present Value of $1 for "n" Periods at "i" Rate of Interest . 279
53. Comparison of Amount and Present Value 280
54. The Amount of an Ordinary Annuity of $1 for "n" Periods at "i" Rate of Interest 281
55. The Present Value of an Ordinary Annuity of $1 for "n" Periods at "i" Rate of Interest 282
56. Development of Sinking Fund Principle 283
57. Development of Amortization Principle 285
58. The Component Parts of a $1,000 Bond 288
59. Depreciation Curves 319
60. A Page of a Plant Ledger 320
61. Diagrams to Illustrate Compilation of a Standard Cost 339
62. Comparisons of Actual and Standard Costs 342
63 to 65. Diagrams of Standard Cost Plans 349, 351, 353
66, 67. Forms of International Bedaux Company 362, 363
68. Diagram of Shop Accounting System 365
69. Diagram of Accounts 375
70. Chart of Budgetary Control 378
71. Expense Budget Form 381
72. Estimated Operating Statement 382
73. Estimated Profit and Loss Statement 383
74. Estimated Balance Sheet 383
75. Report on Budget Realization 385
76. Balance Sheet, Mercer Manufacturing Company 389
77. Comparative Balance Sheet, Mercer Manufacturing Company . . 392
78. Comparative Balance Sheet, Mercer Manufacturing Company . . 393
79. Income and Expense Statement, Mercer Manufacturing Company 399
80. Income and Expense Statement, Mercer Manufacturing Company 401
81. Curve to Illustrate Establishment of a Normal Year 416
82. Accounting Machine Ledger Page 419
83. Remington Accounting Machine 423
84 to 86. Illustrations of Burroughs Accounting Machine 425, 426
87 to 92. Illustrations of Elliott Fisher Machines 428–432
93, 94. Powers Tabulating Cards 433
95 to 98. Illustrations of Power Machines 434–436
99. Tabulating Card and Machine 436
100. Report from Tabulating Cards 437
101 to 103. Illustrations of International Machine 438, 439

INDUSTRIAL ACCOUNTING FOR EXECUTIVES

INTRODUCTION

Before studying a subject it is always worth while to know something of its background, and to see how the principles developed during the years of evolution apply to the subject as it is known today. It is further well worth while to endeavor to understand how such a subject may be related to a particular field.

Since the contents of this treatise is primarily for students of industrial engineering and for men in actual industrial positions, it may be shown how these two fields are related, and how the work of modern accounting has been guided by the principles of industrial engineering as set down by Taylor, Gantt, and other pioneers in this field.

With this purpose in mind, it would seem logical first to review briefly the history and development of accounting. The keeping of records has been a part of man's work since the dawn of civilization. While no very definite idea has been left us by the ancients as to their methods of accounting, nevertheless enough facts have been established to prove its existence beyond doubt. Some of the high lights in this historical background are:[1]

1. Babylonian Records, during the rule of Hammurabi (2285 B.C. to 2242 B.C.), which tell of partnerships, drafts, checks, etc.

2. Egyptian Records, where accounts were kept on papyrus, showing a very careful record of the revenues and disbursements of the state.

3. Grecian Records which show the emphasis on accounting for public officials. The Greeks developed a crude clearing-house system.

4. Roman Records, telling of the careful family records kept by the father, and the use of the memorandum record. Checks were used by the wealthy.

[1] KESTER: "Accounting Theory and Practice," Vol. 1, pp. 1–8, 1920.

5. Early English Records describing the tally-stick system. When a transaction was made a stick was cut with notches corresponding to the number of articles involved in the transaction. The stick was then split, one half going to each party. When the final reckoning took place the two halves of the stick were matched to prevent any error or forgery in the settlement of the account.

6. Italian Records during the twelfth and thirteenth centuries, from which was gained our knowledge of double-entry principles. Luca Paciolo, a monk mathematician formulated a double-entry system of keeping accounts in the City of Venice. His system is sometimes called the method of Venice.

The principles laid down by Luca Paciolo are just as true today as they were during the twelfth and thirteenth centuries when their evolution took place. Today, however, many labor-saving and time-saving methods and machines are in use, and their work greatly simplifies the tasks of the bookkeeper and the accountant. Witness today the great growth of bookkeeping machinery, mechanical sorting and tabulating devices, etc. that have brought about the same division of labor within the office that automatic machines have brought within the shop.

With accounting background thus established, the field of industrial engineering may be briefly considered and its effect upon accounting shown. This can very aptly be gleaned from an address made by L. P. Alford, Editor of *Manufacturing Industries,* to the Industrial Engineering Seniors at Cornell University, in which he showed very clearly how the two fields are related. Briefly his talk may be outlined as follows:

1. *Production control*[1] which was associated largely with the name of Frederick W. Taylor, the father of scientific management, and brought sharply to public attention by his great papers presented in 1903.

2. *Labor management,*[2] headed by Henry L. Gantt, Taylor's associate and a great humanizer, who applied many of Taylor's principles, at the same time retaining the human side. This work occurred about 1908.[3]

[1] See Taylor, Frederick W., "Principle of Scientific Management"; "Shop Management."

[2] Gantt, H. L., "Work, Wages and Profits."

[3] Many of these principles were recognized and in use long before the time of Taylor and Gantt. It remained, however, for these great industrial leaders to weave certain growing fundamentals into a philosophy of management.

3. *Standard costs in accounting*, written about and developed by G. Charter Harrison, the English accountant, in 1918.

4. *Principles of budgetary control*, made prominent by the writings of Prof. J. O. McKinsey in 1922.

It was claimed by many that Taylor was a hard taskmaster. He lacked somewhat the human side which was contributed to the field of industrial engineering by Henry L. Gantt in his work on labor management. The work of these two great pioneers in scientific management, with its principles of planning and predetermination ever in the foreground, was to have its effect upon the accounting profession. Accountants had for years been able to give the works manager only historical figures. It remained for G. Charter Harrison, the English accountant, to go back, and read and study very carefully the works of Taylor and Gantt, and to apply them to the accounting profession. In 1918, when he brought out his principles of standard costs, he set himself up as a target for the large majority of professional accountants. The principles which held so well for the shop applied equally well to the office and Mr. Harrison's work on standard costs is making tremendous headway in all industries today. The budget and budgetary control have been in use for many years by municipalities, but it remained for Prof. J. O. McKinsey of the University of Chicago to bring home the realization of its full value to industry.

Each step outlined above represents a great movement which, gathering in volume for years, is brought clearly and sharply to a head by some one man whose name is henceforth associated with it.

H. R. Hatfield of the University of California in a recent paper (1927) entitled, "What Is the Matter with Accounting?" said:

> In addition, I would mention three achievements, one of practical, one of pedagogical, one of theoretical, interest. The first is the development of cost accounting (due to engineers rather than to professional accountants, but still an achievement in the science). This I consider the typical contribution of the present generation.
>
> The second is the substitution, for the idea that bookkeeping is, in essence, a mere matching of debits and credits, of the view that its significant aspect is its striving to present the equation:
>
> Assets = Liabilities + Proprietorship.

The name of the honored and lamented Sprague stands prominent in this movement. But it was formulated long before his day, and can be

traced back to German, American, and English writers, for more than a hundred years. But the general adoption of the so-called "balance-sheet approach" in place of the purely journal method is a recent matter. Paciolo and his immediate successors give no hint of it.

The third point is the effort to introduce some unity into accounting theory, instead of regarding its phenomena as diverse. For a long time it was generally considered that the investment of capital was in marked opposition to the payment of an expense. This view was crystallized in the phrase "capital expenditure or charge against revenue." It assumed that these two were radically different in nature, and one must never be confounded with the other. Today, one sees a continuous gradation, land, building, machinery, raw material, expense of labor—each one of a series, each differing only as to length of the service which it renders, each paid for with the view of getting all possible use out of it in the productive process. The development of this point of view is, I believe, a real achievement in accounting theory—one not dreamt of in earlier centuries.

These developments strike very closely to the work of the engineer, and, if the practice of accounting be attacked with an engineering viewpoint, realizing that all transactions may be related to the fundamental equation,

$$\text{Assets} = \text{Liabilities} + \text{Proprietorship},$$

such problems may be reasoned and solved in the same manner as are those of mechanics, kinematics, etc.

Before a plunge is taken into the technicalities of bookkeeping and accounting, it may be well to pause for a moment to define the terms and view the situation as a whole—in other words, to find out what it is all about.

Definition.

Bookkeeping is the systematic and chronological recording of facts in respect to the ownership and transfer of values. It may vary from crude methods to highly developed procedure.

Accounting is more comprehensive than bookkeeping. It embraces all methods or schemes for recording facts and *interpreting their results.*

For many years people held the bookkeeping view, and those who entered that field were doomed to a life on a high stool, poring over dusty ledgers.

In recent years, however, this viewpoint has changed and many of the executives and captains of industry of today have

received their training in the accounting and statistical field. Their viewpoint has been one of *interpretation* and *action.*

Story of W. S. Gifford, Statistician

Probably the outstanding example of the present era of Captains of Industry is W. S. Gifford, President of the American Telephone and Telegraph Company, a brief outline of whose rapid rise appears in the September, 1927, number of the *Magazine of Business.*

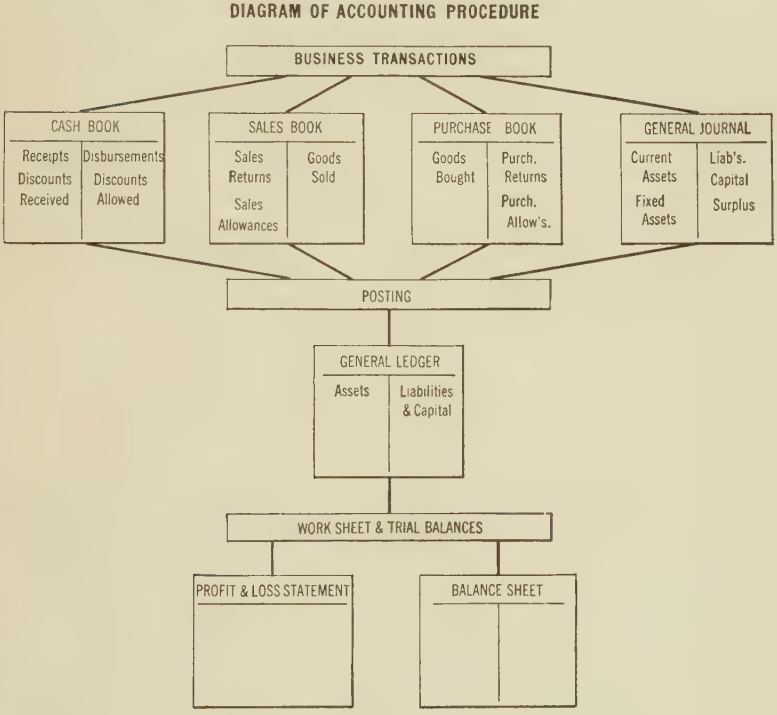


Fig. 1.

When Walter Sherman Gifford graduated from Harvard University in 1905, at the age of twenty, he wrote two letters applying for jobs—one to the Western Electric Company, the other to the General Electric Company. Into the envelope, addressed to the Chicago Company, went his General Electric Company letter; to Schenectady went the Chicago letter. That was the chance that started him off to the presidency of the American Telephone and Telegraph Company, for the Western Electric Company gave him a clerkship. Just 20 years later

he was elected president of this $2,000,000,000 corporation—the position he now holds.

Mr. Gifford's speciality is statistics. In 1908 he joined the American Telephone and Telegraph Company as chief statistician, and amazed President Theodore N. Vail with his informative company charts. Later, as supervising director of the Committee on Industrial Preparedness and then as director of the Council of National Defense, he inventoried American industry and measured its potentialities.

In order to obtain a bird's-eye view of accounting procedure, to get a clear conception of what the important accounting statements are and how they are obtained, it becomes increasingly necessary to reduce such procedure to diagrammatic form.

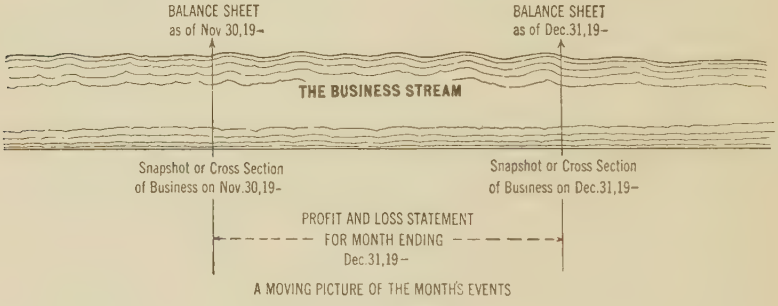


Fig. 2.

Figure 1 was designed to give an overall picture of accounting procedure. In the Cash Book, Sales Book, Purchase Book and General Journal are recorded the business transactions in chronological order, that is, consecutively, day by day, as they occur.

It is necessary however to assemble all these transactions in account form in one general book. This book is called the "ledger," and the act of carrying the original entries from the books of daily record to the *ledger* is called "posting."

In order to obtain the financial statements, certain "accounting tools"—the work sheet and trial balances—are applied to the ledger and, by separating and adjusting its accounts and arranging them in statement form, the Balance Sheet and the Profit and Loss Statement are obtained.

What these statements are is shown in Fig. 2. The Balance Sheet is a cross-section of the business stream, while the Profit and Loss Statement records the progress made between two suc-

cessive Balance Sheets. The first is static, a *snapshot* of the business, while the latter is dynamic, a *moving picture* of the business.

With these pictures clearly in mind, a study of the basic principles is now in order.

PART I

CHAPTER I

FUNDAMENTAL ELEMENTS OF ACCOUNTING

OBJECT OF THIS CHAPTER: To show the fundamental Balance-Sheet relationships.

Asset = Liabilities + Capital: A Fundamental Expression.

A business, from the accounting viewpoint, is a unit in itself, and considered a thing apart from the owner or owners. Many complications arise under modern forms of organization, but, in spite of these, each business is a unit in so far as accounting practice and procedure is concerned.

The great underlying fundamental upon which all accounting is based is the condition found in every business, namely, that its assets are equal to its liabilities. This backbone of all accounting is expressed by an equation called the "proprietorship equation," or the "accounting equation."

It is written

Assets = Liabilities *to people outside of the business* + Liabilities *to the owners of the business.*

If the terms used in the equation be defined, it may be stated in a little simpler and more familiar form. The assets of a person, firm, or corporation are the value of things *owned.* The liabilities of a person, firm, or corporation are the value of things *owed*, and these may be divided into two classes as shown above; namely, (*a*) *liabilities to people outside of the business*, and (*b*) *liabilities to owners of the business.* By a common custom (*a*) is referred to as just plain "Liabilities," while (*b*) is called "Proprietorship," "Capital," or "Net Worth." The equation may then be stated in the simple terms of

$$\text{Assets} = \text{Liabilities} + \left\{ \begin{array}{l} \text{Capital, or} \\ \text{Proprietorship,} \\ \text{or Net Worth.} \end{array} \right.$$

Technique of Proprietorship Equation.

A Simple Balance Sheet.—Since a business is a unit in itself, the proprietorship equation springs into existence immediately upon the formation of the business and remains in existence all through the life of the business. However, the parts which make it up are constantly undergoing a change. Its formation and the way in which the elements composing it are changing from time to time may be readily understood by the following illustration:

Assume that on Jan. 1, 19—, J. R. Brown starts business by investing $15,000 cash capital in the enterprise.

1. By the proprietorship equation,

Assets (cash $15,000) = Proprietorship ($15,000).

As yet, there are no liabilities. In order to carry on his business, however, Brown must purchase a stock of merchandise and equipment for his store.

2. He buys equipment (value $900) from the Bailey Electric Company on 60 days' time.

The equation now is

Assets (cash $15,000 + equipment $900) = Liabilities (Bailey Electric Company's claim $900) + Capital ($15,000).

3. He buys a stock of merchandise for $2,500 from Gurber-Sterling Company on 10 days' time.

The equation now becomes

Assets (cash $15,000 + equipment $900 + merchandise $2,500) = Liabilities (Bailey Electric Company's claim $900 + Gurber-Sterling Company's claim $2,500) + Proprietorship ($15,000).

He now has more assets than the original $15,000 cash but he has become indebted for the additional amount. The equation may now be shown in the form of a statement.

J. R. Brown

Statement of Assets, Liabilities and Capital as at beginning of business Jan. 1, 19—

Assets (left)		Liabilities and Capital (right)	
Cash	$15,000	Bailey Electric Company's claim	$ 900
Equipment	900	Gurber-Sterling Company's claim	2,500
Merchandise	2,500	J. R. Brown, Capital	15,000
	$18,400		$18,400

This is really a Balance Sheet in its simplest form. It is a summary of the assets, liabilities, and proprietorship of a business, systematically arranged, to set forth its financial condition at a given instant of time. It is a cross-section of the business stream at some specific instant. It is a static condition of the business and comparable to a snapshot photograph.

Elements of the Balance Sheet of a Manufacturing Company.

With the knowledge thus gained of the proprietorship equation, the development of a Balance Sheet for a manufacturing company may be undertaken. Remembering the fundamental,

$$\text{Assets} = \text{Liabilities} + \left\{ \begin{array}{l} \text{Capital, or} \\ \text{Proprietorship, or,} \\ \text{Net Worth} \end{array} \right.$$

let it be assumed that the Campbell Manufacturing Company had total assets amounting to $87,493 on Dec. 31, 19—. The most simple method of expressing this fact in balance sheet form would be:

THE CAMPBELL MANUFACTURING COMPANY

Balance Sheet as of Dec. 31, 19—
Assets ($87,493) = Liabilities ($87,493).

Classification of Assets.

The assets of the Campbell Manufacturing Company may consist of a number of different kinds of values. Let the following be assumed:

Cash	$12,450
Accounts Receivable	4,607
Inventories	23,712
Fixed Assets (land etc.)	45,000
Prepaid Expense	1,724
Total Assets	$87,493

Liabilities.

From what source did the Campbell Manufacturing Company secure the money with which it was enabled to hold these values?

Usually, the source of assets is twofold: contributed by owners and contributed by the creditors. Here is an important division, because funds contributed by the owners represent their perma-

nent investment in the business, being equivalent, in many respects, to a loan with no definitely specified date of payment, whereas funds contributed by creditors are legal obligations which must be met within a specified time.

Let the classification of the liabilities as of Dec. 31, 19—, be assumed as:

1. Contributed by Creditors	
1. Notes Payable	$ 9,325
2. Accounts Payable	3,710
3. Mortgage on Building	6,294
	$19,329

Net Worth.

The funds contributed by the owners usually arise from two sources: the amounts put into the business as *investments* and *profits* that have accumulated and have not been withdrawn.

In the case of businesses operating under the corporate form of organization, the amounts put in as investments are usually represented by the *capital stock outstanding* and the accumulated profits that have not been withdrawn are usually represented by *surplus.* Both of these items can be classified in the Balance Sheet under the group name *net worth* and, frequently, the sum of the two is described as *net worth.*

Classification of Net Worth.

In order to complete the illustration of the Campbell Manufacturing Company, let the following be assumed:

2. Contributed by Owners:	
Capital Stock Outstanding	$50,000
Surplus	18,164
Total	$68,164

The Complete Balance Sheet.

This completes the development of the equation of the Campbell Manufacturing Company's Balance Sheet as of Dec. 31, 19—, and it may be shown in more detailed form by substituting the details for the single figures of $87,493 shown in the first equation.[1]

[1] GILMAN, S., "Analyzing Financial Statements."

THE CAMPBELL MANUFACTURING COMPANY
Balance Sheet as of Dec. 31, 19—

Assets	=	Liabilities + Capital		
Cash	$12,450	Notes Payable	$9,325	
Accounts Receivable	4,607	Accounts Payable	3,710	
Inventories	23,712	Mortgage on Building	6,294	
Fixed Assets	45,000	Total Liabilities		$19,329
Prepaid Expense	1,724	Capital Stock Out standing	$50,000	
		Surplus	18,164	
		Net Worth		$68,164
		Total Liabilities and Net Worth		
Total Assets	$87,493			$87,493

Form of the Balance Sheet.

Balance Sheets may be presented in two different forms: the account form, as illustrated in the preceding—*assets on left and liabilities and capital on right;* and the *statement* form, as illustrated in the following—*assets* above and *liabilities* and *capital* below.

THE CAMPBELL MANUFACTURING COMPANY
Balance Sheet as of Dec. 31, 19—

Assets		
Cash	$12,450	
Accounts Receivable	4,607	
Inventories	23,712	
Fixed Assets	45,000	
Prepaid Expense	1,724	
		$87,493
Liabilities and Capital		
Notes Payable	$ 9,325	
Accounts Payable	3,710	
Mortgage on Building	6,294	
Total Liabilities		$19,329
Net Worth (excess of assets)		$68,164
Represented by:		
Capital Stock Outstanding	$50,000	
Surplus	18,164	
		$68,164

This form of Balance Sheet is preferred by some because it shows how net worth is obtained more clearly—it is the *excess*

of *assets* over liabilities. *The Balance Sheet is a Picture of the Financial Structure of the Business.*[1]

It should be clearly borne in mind, however, that a Balance Sheet is not a "cold statement" of assets and liabilities. It is really a picture of the financial structure of an organization stated in dollars and cents, and indicating what the *business owns, what it owes,* and *what it is worth, net.*

The foregoing statement should be considered as pictures of the financial structure of the Campbell Manufacturing Company. The items and the sums stated should not be thought of as mere sums of money, but a *look should be taken beyond the figures* and the quantities of goods, the investments represented, and the various sources from which capital is secured should be visualized to the point of reality.

A representative problem to illustrate these points follows:

Problem 1.

On Sept. 1, 19—, J. Bauer starts in business and has the following assets and liabilities which are to be classified for balance-sheet purposes changing the descriptions here used to standard titles.

He bought a piece of land 200 by 125 feet costing $4,000. He erected a plant for manufacturing purposes costing $23,000. There is an indebtedness on the building amounting to $9,000, which is held by Brown and Brown Company.

In the plant, Bauer has installed manufacturing apparatus amounting to $28,250, and tools and small devices amounting to $725.

Office furniture and equipment cost $482.50. He has cash on hand amounting to $312.50. Cash in bank amounts to $743.10.

Customers owe him for goods bought on open accounts $3,125 and on signed promises to pay $634.

Bauer owes on account $4,526.50, and on signed notes $321.75.

Bauer has stock in the plant consisting of the following:

Raw Materials	$5,643
Partly Finished Goods	3,765
Finished Goods	3,420

Draw up a statement showing assets, liabilities, and net worth, using standard titles.[2]

[1] Bliss, J. H., "Management through Accounts."

[2] See Kester, R. B., "Accounting Theory and Practice Solutions."

SOLUTION TO PROBLEM 1

J. BAUER

Balance Sheet as of Sept. 1, 19—

Assets			
Cash in Bank	$ 743.10		
Cash on Hand	312.50	$ 1,055.60	
Notes Receivable		634.00	
Accounts Receivable		3,125.00	
Merchandise:			
Raw Materials	$5,643.00		
Partly Finished Goods	3,765.00		
Finished Goods	3,420.00	12,828.00	
Furniture and Equipment		482.50	
Machinery		28,250.00	
Tools		725.00	
Building		23,000.00	
Land		4,000.00	
Total Assets			$74,100.10
Liabilities			
Notes Payable		$ 321.75	
Accounts Payable		4,526.50	
Mortgage Payable		9,000.00	
Total Liabilities			$13,848.25
Proprietorship			
J. Bauer, Capital			$60,251.85

SUMMARY

The following accounting points were emphasized in Chap. I.

1. The foundation of all double-entry bookkeeping is the proprietorship or accounting equation,

$$\text{Assets} = \text{Liabilities} + \begin{cases} \text{Capital, or} \\ \text{Proprietorship, or} \\ \text{Net Worth.} \end{cases}$$

2. Operation of the equation.

3. Development of the two forms of Balance Sheet—the *account form* and the *statement form.*

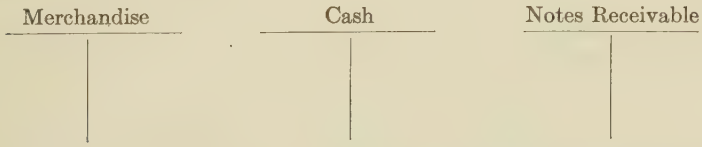
CHAPTER II

THE ACCOUNTING TRANSACTION

OBJECT OF CHAPTER: (*a*) to develop the account; (*b*) to develop the theory of debit and credit; (*c*) to show the analysis of mixed transactions.

The Account—Its Definition and Technique.

It was shown in Chap. I that any business transaction could be broken down and its effect shown on the proprietorship equation. Let it further be clearly understood that *the sum of the left-side entries* of the equation must in all cases equal *the sum of the right-side entries* with respect to the proprietorship equation. This is the basis of double-entry bookkeeping which will now be more fully developed. In order to collect all transactions referring to the same thing or person, an accounting classification known as the "account" is set up. The account may be defined as a chronological gathering of left-side and right-side entries, relating to the same thing or persons, which come about as the result of doing business, and are recorded under the proper heading or title. To illustrate the principles of entry, so-called skeleton ledger or T accounts are used. They really represent, in skeleton form, the ruling of the ledger page itself and are merely used at this stage to simplify the procedure. Examples of T accounts are:



Before certain items may be placed within accounts, it becomes very necessary to be thoroughly able to classify these items. From the proprietorship equation, it may be seen that there will be accounts pertaining to assets, liabilities, and capital. Asset accounts refer to things *owned* by the person, persons, or corporation. Liabilities refer to things they *owe*. Capital or proprietorship is the *difference between the assets and the liabilities*. Assets

and liabilities may be readily understood and usually offer very little difficulty. Proprietorship accounts, however, will require some explanation. They may be looked upon as *recording the effects of business transactions upon the capital or proprietorship.* Proprietorship accounts will be divided into two classes: First, Permanent Proprietorship accounts which are set up to record the original investment and its subsequent changes, and second, Temporary Proprietorship accounts which record the receipt of income and the payment of expenses. These latter transactions result in a profit or loss, and their net result is, at the end of the accounting period, transferred to the Permanent Proprietorship account. In the procedure to develop the T account, five principal classifications of items involved in a financial transaction will be referred to. They are (1) Asset accounts, (2) Liability accounts, (3) Permanent Proprietorship accounts, (4) Temporary Proprietorship Income accounts, (5) Temporary Proprietorship Outgo or Expense accounts. Diagramatically, this classification may be expressed as follows:

Assets = Liabilities + Capital

Capital = Permanent + Temporary

Temporary = Income − Outgo.

Referring to Fig. 1, it is important that the student realize that all explanations that will follow in this chapter deal with the ledger alone. The ledger is known as the book of final entry and is based upon the basic equation:

Assets = Liabilities + Capital.

For the present, then, consider that *only direct ledger entries are made,* ignoring entirely the rest of the accounting system.

SCHEDULE FOR POSTING TO LEDGER ACCOUNTS[1]

	Left	=	Right
	Assets	=	Liabilities + Capital
Left-side entries	*A.* Add to Assets		*a.* Subtract from Assets
	B. Subtract from Liabilities		*b.* Add to Liabilities
	C. Subtract from Capital		*c.* Add to Capital

Right-side entries

(There are nine possible combinations from the schedule, namely, *Aa Ab, Ac, Ba, Bb, Bc, Ca, Cb, Cc.*)

[1] KESTER, R. B., "Accounting Theory and Practice," Vol. 1, p. 82, 1922.

The work of the journal and other account books will later enter into the scheme of things, as labor and time-saving devices. With the ledger or the fundamental book of accounting in mind certain rules of the double-entry system may be formulated.

The foregoing schedule illustrates what effect may be brought to bear upon the accounting equation for any type of entry, either left side or right side. It will be seen from this schedule that nine different combinations are possible.

Some of these are fairly simple and their content can be readily understood with the present knowledge of the subject. Others, which are more involved and require visualization of certain previous transactions, will be omitted for the present and only the more straightforward entries will be illustrated.

Procedure for Making Entries to T Accounts.

First, classify the items concerned in the business transaction as to whether they are

1. Assets.
2. Liabilities.
3. Permanent Capital or Proprietorship.
4. Temporary Capital—Income.
5. Temporary Capital—Outgo.

Second, note if the items represent an increase or decrease in 1, 2, 3, 4, or 5, and enter accordingly on the left or right side of the accounts concerned. The transaction will fall within one of the nine combinations possible in the preceeding schedule of entries.

Examples will be given for the purpose of illustrating the different classes of transactions and the manner of determining their place of entry. The *double point* of view should be constantly kept in mind. In double-entry bookkeeping, there are always balancing entries and the original and basic proprietorship equation,

$$\text{Assets} = \text{Liabilities} + \text{Capital},$$

is always in equilibrium. It should further be remembered *always to record transactions from the standpoint of the business whose records are being kept.* That is why the name of the firm whose books are being kept is stated in the following illustrations.

(Engineers' Note.—The accountant rarely subtracts. Thus when it is necessary to reduce a *left-side entry* instead of subtracting from the left side, an addition is made on the *right side.*)

1. R. L. Jones invests $10,000 cash in his business. This causes an increase of the asset cash and an increase in proprietorship or capital. Entries are made as in (*A*) and (*c*).

Cash	
$10,000	

R. L. Jones, Capital	
	$10,000

Books of R. L. Jones

2. The purchase of $200 merchandise for cash by R. L. Jones. The result is an increase in the asset merchandise and a decrease in the asset cash. The entries, as shown by the schedule above, come under (*A*) and (*a*), *i.e.*, left-side entry, merchandise, right-side entry, cash, as illustrated by the T accounts.

Merchandise	
$200	

Cash	
	$200

Books of R. L. Jones

3. The purchase of $500 furniture and fixtures by R. L. Jones on account from the Brown Furniture Company. This results in an increase of assets caused by the increase of liabilities. The entries come under (*A*) and (*b*). T accounts will show:

Furniture and Fixtures	
$500	

Brown Furniture Company	
	$500

Books of R. L. Jones

4. The receipt by R. L. Jones of $150 in cash for interest earned on bonds. The result here is an increase in the asset cash caused by an increase in the Temporary Proprietorship Income account which may be called "interest earned on bonds." The schedule shows under (*A*) and (*c*) the entries required. T accounts will show,

Cash	
$150	

Interest Earned	
	$150

Books of R. L. Jones

5. A workman is paid in cash his wages of $50 by R. L. Jones. The result is a decrease in the Temporary Proprietorship and a decrease in the asset cash. Wages are a cost of doing business and, therefore, decrease proprietorship. The schedule shows under (*C*) and (*a*) the entries required. T accounts will show,

Books of R. L. Jones

The principles illustrated in the simple examples which have preceded may be put into practice considering the ledger in the form of a diagram which may be drawn up on one sheet. This will have the advantage of giving the student a complete view of the whole transaction at a glance, and will save him the trouble and confusion of skipping from page to page. For this illustration may be assumed certain representative entries that might take place in an average-sized electrical supply business. A small number of entries will be taken for the purpose of avoiding confusion that greater detail would be sure to cause at this stage of development.

Problem 1.

Sept. 1. J. L. Decker invests $15,000 in cash in the electrical supply business.
2. Buys for cash merchandise, $500.
3. Buys store fixtures from the Rockwell Fixture Company on time, $200.
5. Sells merchandise for cash, $150.
6. Sells $105 merchandise to the X Novelty Company taking their 60-day note.
7. Buys merchandise for cash, $280.
8. Pays rent for month of October, $150.
9. Pays clerk's salary, $35.

First, let each transaction be considered as a part in itself, the entries being made according to the principles of the proprietorship equation.

Assets = Liabilities + Capital

(Sept. 1)

$A = L + C$

Cash	
$15,000	

	J. L. Decker, Capital
	$15,000

1. Increase in Asset Cash.
2. Increase in Permanent Capital.

(Sept. 2)

$A = L + C$

Cash	
	$500

Merchandise	
$500	

1. Decrease in Asset Cash.
2. Increase in Asset Merchandise.

(Sept. 3)

$A = L + C$

Store Fixtures	
$200	

	Rockwell Fixture Company
	$200

1. Increase in Asset Fixtures.
2. Increase in Liability Accounts Payable.

(Sept. 5)

$A = L + C$

Cash	
$150	

Merchandise	
	$150

1. Increase in Asset Cash.
2. Decrease in Asset Merchandise.

(Sept. 6)

$A = L + C$

Merchandise	
	$105

Notes Receivable	
$105	

1. Decrease in Assets Merchandise.
2. Increase in Assets Notes Receivable.

(Sept. 7)

$A = L + C$

Cash	
	$280

Merchandise	
$280	

1. Decrease in Asset Cash.
2. Increase in Asset Merchandise.

(Sept. 8)

$A = L + C$

Cash	
	$150

Rent	
$150	

1. Decrease in Asset Cash.
2. Decrease in Temporary Proprietorship; Rent Outgo.

(Sept. 9)

$A = L + C$

Cash	
	$35

Salaries	
$35	

1. Decrease in Asset Cash.
2. Decrease in Temporary Proprietorship; Salaries Outgo.

A Diagram of the Ledger, or the "Diagrammatic Ledger Plan."[1]

Having solved each transaction separately, the problem with respect to the ledger as a whole, may now be considered.

To do this, the plan shown in Fig. 3 is adopted. The large T represents the master T account and is a symbol for the whole

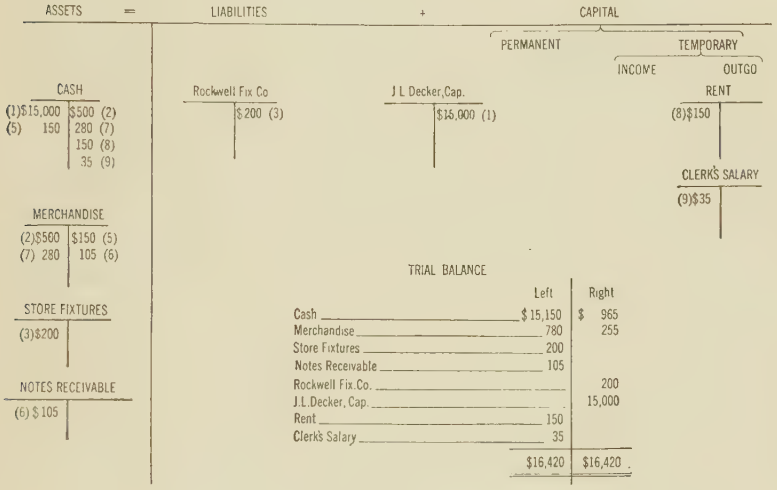


FIG. 3.

ledger, which must always be in balance according to the fundamental equation,

$$\text{Assets} = \text{Liabilities} + \text{Capital}.$$

The ledger, or master T account, is made up of all the small T accounts which make up the accounting for the business. Each transaction involving two or more T accounts is governed by

$$\text{Assets} = \text{Liabilities} + \text{Capital},$$

as shown in the solution thus far. It follows then that the T accounts involving each of the preceding transactions *may be placed within the master T account where they will be accurately classified as to Assets, Liabilities, Permanent Capital, Temporary Capital Income, Temporary Capital Outgo or Expense.* At any time this plan should be in balance; namely, the sum of the *left-*

[1] WOODBRIDGE, F. W., "Elements of Accounting," p. 69.
KOHLER and MORRISON, "Principles of Accounting," pp. 25–37.

side entries should be equal to *the sum of the right-side entries* because the equation,

$$\text{Assets} = \text{Liabilities} + \text{Capital},$$

governs each transaction.

This plan of presentation has the advantage of giving the beginner a bird's-eye view of the whole ledger scheme. It makes the process of using the conventionally ruled ledger pages much simpler because he sees the end in view.

The solution may then be checked by taking the sum of the left-side entries in each account and the sums of the right-side entries of each account. If the accounts with their totals are now listed, as shown in Fig. 3, such totals are in balance and a mathematical check of the accuracy of the work is thus obtained. This process is known as taking a "trial balance" and this particular method of doing it is known as the "trial balance of sums or of totals."

In first studying the principles of the double-entry system, the basic equation,

$$\begin{array}{lcl} \text{Left} & = & \text{Right} \\ \text{Assets} & = & \text{Liabilities} + \text{Capital}, \end{array}$$

should always be remembered and entries made should be analyzed for their effect upon it. Further, for every entry, it should be definitely recalled, there is an offsetting or balancing entry.

By convention, custom, etc., the left side is called the "debit side" and the right side the "credit side." Entries should not be made however, with the everyday meanings of debit and credit in mind. Each transaction should be traced back to the basic equation and then *left-side* and *right-side* entries made.

If, then, it be borne clearly in mind that the *left-side entries* are *debits*, and *right-side entries* are *credits*, the principle of double-entry bookkeeping has been developed in the form that is so commonly quoted, *i.e.*, for every *debit* there must be a corresponding *credit*.

Analysis of Mixed Transactions.[1]

While it required some little thought to analyze the mechanics of the simple illustrations given previously, the accountant is

[1] WOODBRIDGE, F. W., "Elements of Accounting," p. 79.

continually confronted with *mixed* or *combined* transactions which require even more careful analysis. To illustrate:

1. A. L. Wilson buys a motor truck for $1,800, paying $1,000 in cash and giving his note for the balance. This transaction involves:

An increase of an Asset account.
A decrease of an Asset account.
An increase of a Liability account.

Cash		Delivery Equipment		Notes Payable	
	$1,000	$1,800			$800

	Dr.	Cr.
Delivery Equipment	$1,800	
Cash		$1,000
Notes Payable		800
	$1,800	$1,800

2. L. C. Dodds buys a store building and a lot for $2,800, the lot being worth $600 and the building $2,200. Dodds pays $1,200 in cash, giving a mortgage on his property for the remainder. This transaction illustrates:

An increase in two Asset accounts.
A decrease in one Asset account.
An increase in one Liability account.

Land		Building		Cash		Mortgage Payable	
$600		$2,200			$1,200		$1,600

	Dr.	Cr.
Land	$ 600	
Building	2,200	
Cash		$1,200
Notes Payable		1,600
	$2,800	$2,800

Note carefully in combined or mixed transactions the total of the debit entries must equal the total of the credit entries for each transaction.

SUMMARY

The following accounting points were emphasized in Chap. II.

1. Every business transaction can be related to the accounting equation:

$$\text{Assets} = \text{Liabilities} + \text{Capital}.$$

2. A statement in the ledger covering the transactions or standing of some particular person, company, or thing is called an "account."

3. The Temporary Proprietorship Accounts show the receipt of income and the payment of expense and are constantly recording transactions which tend to make or lose money.

4. All transactions will fall into two or more of the following classifications: assets, liabilities, permanent capital, temporary capital income, temporary capital outgo.

5. The Permanent Proprietorship Account summarizes the results of the Temporary Proprietorship Accounts.

6. All entries are made from the point of view of the business whose books are kept.

7. For the purpose of obtaining a bird's-eye view of the ledger as a whole, a diagrammatic ledger plan may be used.

CHAPTER III

SALES, PURCHASES, AND THE COST OF GOODS SOLD

OBJECT OF THIS CHAPTER: (*a*) to show the development of Sales and Purchase accounts from the inadequate Merchandise account; (*b*) to find the Cost of Goods Sold; (*c*) to figure Net Profit.

Old and New Ways of Handling Merchandise Entries.

Old and obsolete systems of bookkeeping use the Merchandise account in the manner shown in Chap. II, Problem 1. It must be distinctly understood that the word merchandise refers to all goods which have been *purchased to resell* to make a profit. If this is clear, a second thought will show that the left side of the Merchandise account represents *purchases at cost price,* and the right-hand side *sales at sales prices.* Thus in the problem of J. L. Decker in Chap. II, page 21, the Merchandise account may be split into two accounts, Purchases and Sales, and classified as follows:

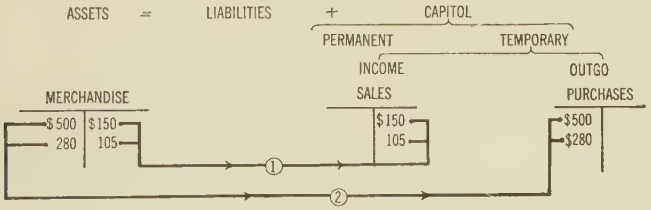


FIG. 3A.

This change is justified for several reasons. When the sale is made, the item includes merchandise and profit. Profit is a capital item. Because it is impracticable to figure the profit on each sale, the item of sale may be placed under some temporary classification until the end of the accounting period arrives, when the profit may be calculated on the business of that period as a whole; hence, the classification under Temporary Proprietorship Income. The right side of the Merchandise account may then be a credit to the Sales account, as shown. This practice is

practically universal because of its managerial and statistical value.

In the same manner, the left side of Merchandise is carried to a Temporary Proprietorship Outgo account called "Purchases." From the Purchase account the cost of goods sold may be calculated by properly adjusting this account, and *purchase cost of goods sold* may, in this manner, be carried in a Temporary Proprietorship account alongside of its neighbor, Sales.

The old Merchandise account offers other inadequacies, however, which the following illustration will bring out:

1. James Dixon began business with $2,600 in merchandise.
2. Buys merchandise for $1,150 on account from Wagner & Company.
3. Sells merchandise for $950, on account, to Beal and Company.
4. Dixon returns to Wagner and Company $400 merchandise because of inferior grade.
5. Beal and Company returned $125 worth of merchandise because it did not meet requirements.

Showing such items in a Merchandise account, they would appear as

Merchandise

(1)	$2,600	(3)	$950
(2)	1,150	(4)	400
(5)	125		

(offsetting entries to other accounts not shown)

Books of James Dixon

From this illustration, it can be seen that the Merchandise account contains three items of information: *inventory*, *purchase*, or increases during the period, and *sales*, or decreases during the period. These last two change because goods are returned to or by us. It is truly a *mixed account*.

This account would be very complicated after an average day's business, say of 400 or 500 transactions. To get the volume of sales for the sales manager would require a lot of analysis and clerical labor. The same applies to purchases.

To save time, but especially to obtain information quickly for the executive, the Merchandise account is expanded into at least three accounts: Merchandise Inventory, Merchandise Sales, and Merchandise Purchases.

James Dixon's books may now be shown using Sales and Purchase accounts as follows:[1]

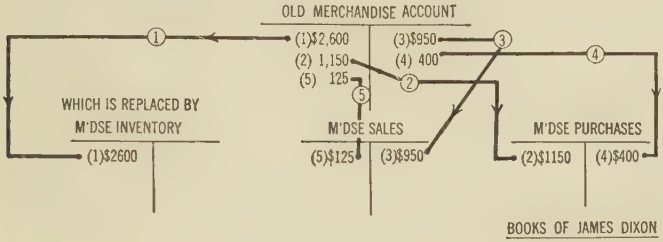


FIG. 3B.

Problem 1.

To illustrate Sales accounts, Purchase accounts, and mixed transactions.

Sept. 1. R. A. Field enters business investing $15,000 in cash and $10,000 in U. S. government bonds.

2. He purchases office furniture and fixtures for $1,000, cash.

3. Purchases from the Continental Truck Company, 1 motor truck, $2,500, paying $1,500 in cash and carrying the balance on account.

4. Purchases from R. A. Bowser Company, $650 worth of merchandise, on account.

5. Purchases from S. A. Wier, $1,200 merchandise for cash.

6. Buys $25 worth of oil and gasoline for the motor truck, paying cash.

7. Sells $238 worth of goods, on account, to A. L. Benson.

8. Sells $156 worth of goods for cash.

9. Purchases, for cash, $353 worth of merchandise.

10. Purchases from R. E. Black, $1,500 worth of merchandise, paying $800 in cash and giving his note for remainder.

11. Sells $750 worth of merchandise to L. O. Dunn, on account.

12. Receives $300 interest on government bonds.

13. Receives $238 note from A. L. Benson.

14. Pays Continental Truck Company $500, cash, and gives note for remainder.

15. Pays rent, $250 and clerks' salaries, $350. (See Figure 4.)

Cost of Goods Sold.

Fundamentally, the cost of merchandise on hand at the beginning of a period + the purchases during the period − the cost of merchandise on hand at the end of the period = the cost of merchandise sold.

Since each item is at cost price, the equation may be stated,

Initial Inventory + Purchases − Final inventory = Cost of Goods Sold,

[1] KOOPMAN-KESTER, "Fundamentals of Accounting," Chap. X.

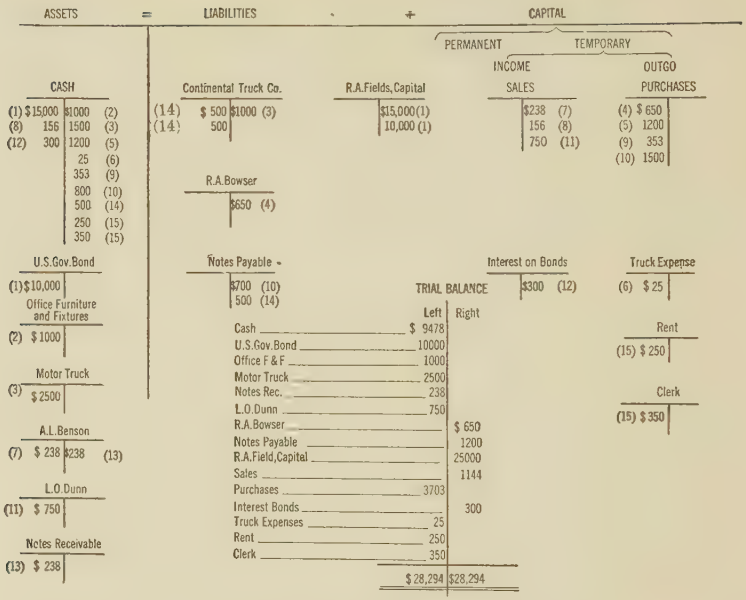


FIG. 4.—Solution to Problem 1.

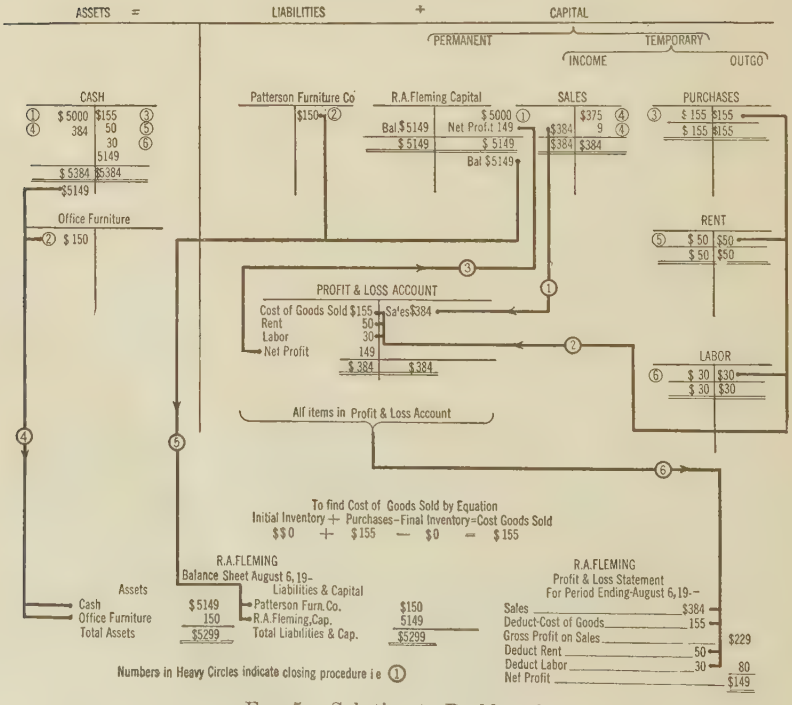


FIG. 5.—Solution to Problem 2.

which is an algebraic expression for cost of goods sold for a trading business.

The following problem of R. A. Fleming is given to illustrate the operation of this equation in its simplest form, and also to show its application to T accounts.

Problem 2.

To illustrate "cost of goods sold" under an ideal case, to figure net profits and to take off statements.

Aug. 1. R. A. Fleming opens a windshield business investing $5,000 cash.
2. He purchases office furniture from the Patterson Furniture Company, $150 on time.
3. Fleming buys 15 windshields and 3 door glasses from the Davis Glass Company for $155, cash.
4. Sold 15 windshields, $375, and 3 door glasses, $9 (this is an ideal case, and is so taken for the purpose of making the illustration simple).
5. Pays rent, $50.
6. Pays labor, $30. (See Figure 5.)

In Fig. 5 the reader is for the first time presented with a Profit and Loss *Statement.* It will be noted from the problem that this statement is a non-technical summary of the items in the Profit and Loss *Account.* It may, in an accounting sense, be looked upon as an expansion of a portion of the net-worth section of the Balance Sheet. Net Worth, it will be recalled is made up of permanent capital and profits (surplus). The Profit and Loss statement shows how the profit was made, and, hence, may be looked upon as an *expansion* of that portion of the Balance Sheet.

Problem 3.

To illustrate finding the cost of goods sold when initial and final inventory are given, to figure net profit, to show the operation of the proprietor's personal account, and to take off statements.

On Jan. 1, 19—, L. S. Conway's Balance Sheet stands as follows:

Assets		Liabilities and Capital		
(a) Cash	$ 600	Notes Payable	$ 400	(c)
(b) Merchandise Inventory	3,000	L. S. Conway, Capital	3,200	(d)
	$3,600		$3,600	

The following transactions occur during January:

1. Merchandise sold for cash, $1,600.
2. Merchandise sold, on account, to R. W. Watson for $400.
3. Conway draws $125 cash for personal use.
4. Merchandise is purchased from T. S. Wilson, $250 on account.

5. Watson turns over $100 bond as part payment of his account and gives his note for the remainder.
6. Merchandise sold to B. J. Diston, on account, $185.
7. Rent is paid for the period, $55.
8. Clerk's salary is paid, $35.
9. Final inventory of merchandise, $1,575.

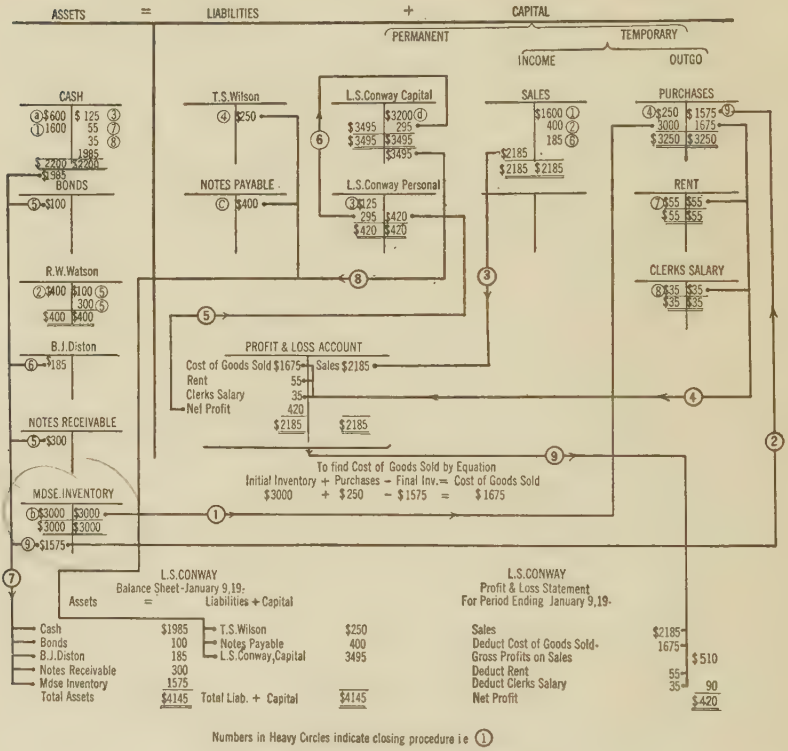


FIG. 6.—Solution to Problem 3.

The Profit and Loss Account and the Profit and Loss Statement.

From the preceding diagrams, the procedure for getting the items from the books into statement form should be obtained. True, the process in a business of even average size is not as simple as pictured here, but the sources are the same and the manner of presenting the final statements is quite comparable.

Care should be exercised not to confuse the Profit and Loss Account with the Profit and Loss Statement. A brief outline of the history of accounts will clear this up.

When enterprises were small, formal statements were unknown. The income and outgo accounts were summarized in the Profit and Loss account and the real items in a Balance Account. These were read and interpreted by the proprietor, who was usually also the bookkeeper. With the growth of business, the proprietor no longer kept his own books, and it became necessary then for the bookkeeper "to take off statements" and present them to him in non-accounting terms. This caused the Balance Account to be dropped and the Balance Sheet put in its place. The Profit and Loss Account was retained because it served the purpose of *summarizing* the income and outgo accounts. It was supplemented, however, by the Profit and Loss Statement—a *document outside the books*, written in non-technical terms for the use of the manager.

The use of the term "profit and loss" account is unfortunate. It really should be called "summary of Income and Outgo accounts" because its debits are outgoes, and its credits incomes.

The fact must be grasped that it is a Summary account—a clearing house for the temporary proprietorship accounts.

SUMMARY

In Chap. III, the following accounting points were emphasized:

1. Modern systems use the Sales and Purchase accounts in place of the obsolete Merchandise account.
2. The cost of goods sold is found from the expression:

Initial Inventory + Purchases − Final Inventory = Cost of Goods Sold.

3. The Profit and Loss Account is a summary account in the ledger which acts as a clearing house for the Temporary Proprietorship Accounts.
4. The Balance Sheet is made up of all the Asset, Liability, and Capital accounts.
5. The Profit and Loss Statement is made up of the Temporary Proprietorship accounts.

CHAPTER IV

INTRODUCTION TO THE BASIC BOOKS OF ACCOUNTING —JOURNAL AND LEDGER

OBJECT OF CHAPTER: To illustrate the procedure of journalizing, posting, and taking a trial balance.

The Journal and the Ledger.

It was previously explained that for the purpose of demonstrating basic relationships, the ledger was used in a diagram-

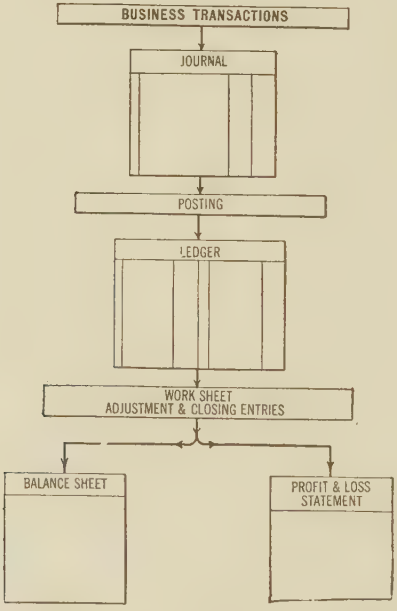


FIG. 7.

matic plan, and entries were made directly to it. Such a scheme, in actual practice, is highly impracticable because:

1. In modern business, many transactions will be reported rapidly, making it extremely difficult to skip over the ledger pages to make the various entries, thus increasing the liability of error.

2 The transaction, once broken up, is difficult to retrace or check back.

3. It is desirable to have each transaction complete in one place, and it should be placed there in chronological order.

Beginning at the top of Fig. 7, page 32, the book of original entry, known as the "Journal" will first be considered. This book is used for the purpose of making debit and credit distinctions.

It may be said that for the purpose of assembling debits and credits by accounts, a book known as the "ledger" is provided, in which all the accounts are kept. The *ledger* is sometimes called the "book of accounts" and is known as the "book of final entry."

The *act of carrying* the entries from the journal to the ledger is known as "posting." Since all account titles have been selected and all debit and credit entries have been made in journalizing, posting is, in fact, a matter of clerical routine.

Journal and Ledger Rulings.

The elementary or two-column journal is usually ruled as follows:

Year Month	Day	Account names and explanation	Ledger page	Dr. Money column	Cr. Money column
		Example			
19— Jan.	1.	Furniture and Fixtures	L-2	$1,500 00	
		Cash	L-1		$1,500 00
		To record the purchase of furniture and fixtures for cash			

NOTE:

1. The debit entry is always made first.
2. The credit entry is indented ½ inch.
3. In the column "Ledger page" the ledger folio or page is given. In this case the Furniture and Fixture account is on page 2 of the ledger and the Cash account on page 1 of the ledger.

The standard form for ledger ruling follows on page 34. It should be noted that the ruling is different from that of the Journal and more nearly follows the account form of balance sheet.

Year Month	Day	Explanation	Journal page	Debit Money column	Year Month	Day	Explanation	Journal page	Credit Money column
				Example Cash					
19— Jan.	1	J. S. Wilcox	J-3	$2,000 00	19— Jan.	2	Brown & Jones	J-5	$1,750 00
	3	Ben Harrison	J-4	150 00		5	Garage Rent	J-7	20 00
	4	Cash Sale	J-6	200 00					

This information may be summarized by noting:

1. The ruling is merely the T account expanded.
2. The year is written on each side as shown for each account.
3. The journal page on which the transaction occured is given; for example, J. S. Wilcox's transaction involving $2,000 appears on page 3 of the journal.

The Trial Balance.

When all transactions have been posted from the journal to the ledger, the total of the *debits in the ledger* should be equal to the total *credits in the ledger* if no errors have been made in posting. This is fundamental and serves as a mathematical check on the accuracy of the postings. True, errors may have been committed and not detected, but, in general, the trial balance serves its purpose well indeed.

There are two methods of taking a trial balance:

1. The method of sums or of totals.
2. The method of differences or of balances.

1. By the method of totals *a trial balance* is taken by listing *all* ledger accounts and placing in parallel money columns opposite each account:

a. The total of the debit side of the account in the left-hand money column,

b. The total of the credit side in the right-hand money column.

2. By the method of balances, a *trial balance* is taken by listing *all ledger accounts which have a debit or credit balance* and placing, in parallel, money columns opposite each account.

a. The balance or difference in the left-hand money column for debit balances,

b. The balance or difference in the right-hand money column for credit balances.

Since the accountant is primarily interested in balances, Method 2 is more often used.

An example of the method of balances, taken from Problem 1, Chap. III, is shown below for the purpose of illustration.

Trial Balance	Left	Right
Cash	$ 9,478	
U. S. Government Bonds	10,000	
Office Furniture and Fixtures	1,000	
Motor Truck	2,500	
Notes Receivable	238	
L. O. Dunn	750	
R. A. Bowser		$ 650
Notes Payable		1,200
R. A. Field, Capital		25,000
Sales		1,144
Purchases	3,703	
Interest on Bonds		300
Truck Expenses	25	
Rent	250	
Clerks' Salary	350	
	$28,294	$28,294

IMPORTANT: At this stage of development, care should be taken not to confuse the trial balance with the Balance Sheet. The trial balance is merely "a *working statement* that must be revised, modified, adjusted, and rearranged into the form of a final statement." *It merely serves as a check on the postings.*

Practical Instructions from Industry.

To obtain a view of the practical side of this work, the following "Works Instruction" of a manufacturing plant is given in detail:

METHOD OF KEEPING THE BOOKS

(Bookkeeping Section Routine)

1. General.

This instruction outlines the method to be followed in keeping the books and other formal records of the company's business.

2. The Books.

Dates and Erasures.—The year covered shall be shown plainly at the top of each ledger page. The day and month shall be shown opposite each ledger posting.

The books of original entry and ledger accounts shall be so kept that all figures are plainly legible and in proper spaces. Only one item shall be placed on a line.

Erasures of any sort are forbidden on the company's ledgers, journals, cash books, capital stock books, and other records which are likely to be called into court, or are subject to auditor's examinations. Errors on such records shall be corrected in a way that will show what the error was and how and by whom it was corrected.

Balances.—In ledgers, debit balances shall be brought down in black ink and credit balances in red ink. Balances shall be brought down each month after all postings for the month have been completed and entered in balance column on line following last posting for the month. The first posting for the next month shall be on the succeeding line. Balances shall not be ruled off. Adding machines shall be used in drawing off trial balances.

When the debit and credit columns of an account are equal, a zero shall be placed in the balance column.

Check System.—A daily check can be secured by the use of check number 11, which is recommended on account of the facility with which it can be used, although the check number 11 does not locate dollars posted as cents or *vice versa*. It is secured by adding the alternate figures of an amount beginning with the right-hand digit and subtracting from this total the total of the alternate figures beginning with the second digit from the right. Where the latter total is the greater, add 11, or a multiple of 11, to the total containing the right-hand digit. 11, or multiples of 11, can also be considered in the check figure as 0. The highest figure written is 10.

The check figure shall be secured from the ledger posting, written in the ledger first and then written in the book of original entry. A check figure shall be secured of the total of each page of books of original entry, and the total of the check figures on this page should equal the check figure for the total of the columns. If it does not, either an examination of the check figure of each amount on the page will show where the error was made or the error will be in the footing of the page.

Check figure shall be secured for all entries, totals, amounts carried forward, and balances, in order to locate errors in transfers of amounts and errors in footings.

The following will show how check figures are obtained:

Posting	Check Figure	How Obtained
$ 6.22	6	$2 + 6 = 8 - 2 = 6$
128.61	2	$1 + 8 + 1 = 10 - (6 + 2)$ or $8 = 2$
1,400.02	5	$2 + 4 = 6 - 1 = 5$
81.90	6	$1 + 22 = 23 - (9 + 8)$ or $17 = 6$
.10	10	0 or $11 - 1 = 10$
8,192.73	4	$3 + 2 + 1 = 6 + 22 = 28 - (7 + 9 + 8)$ or $24 = 4$
$9,809.58	0	$8 + 9 + 8 = 25 - (5 + 9)$ or $14 = 11$ or 0
Total of check figures	0	$6 + 2 + 5 + 6 + 10 + 4 = 33$ or 0

Trial Balance.—At the end of each month a trial balance shall be drawn off from the General Ledger.

Check amounts of journal entries distributing sales and purchases, with totals of recapitulation sheets, and check other journal entries to see that total of debits and credits are equal.

Check postings.

Check additions of books of original entry and recapitulation sheets, paying particular attention to totals carried forward.

Check additions of trial balance sheets, or where footings have been secured, by using an adding machine, making sure that the machine has been cleared before listing was started.

In checking postings, one bookkeeper should take the ledger and another a book of original entry. Start with the first account in the ledger, calling off the amounts posted in the ledger, placing a check mark after the amounts both in the ledger and in the book of original entry. After all the postings have been checked from the ledger, look through the book of original entry for items that have not been checked. After ledger postings have been checked to all books of original entry, look through the ledger for postings that have not been checked. The best check mark is a plain lead pencil dot. Take care that they are put where they can be plainly seen; put them in line and do not use them for any other purpose.

Trial Balance Differences.—If there is an error in the balance which cannot be located, the difference must be reported as called for on the report form. A search for the error shall be made and the books brought into balance before the next trial balance is drawn off.

Errors occur in the following operations:

Posting.

Footing Ledger account and bringing forward or down balances of these accounts.

Drawing off and footing trial balances.

Making out journal entries. (Entries distributing sales and purchases may not equal, in totals, the totals of recapitulation sheets or journal entries may have debits and credits of unequal amount.)

Footing books of original entry. (Cash books, journal entries, and recapitulation sheets.)

To locate the error, the different operations should be rechecked. Beginning with the operation under which errors are most apt to be made, the following order is recommended:

Verify balances in the ledger at the end of each month by taking balances at the beginning of the month and adding or subtracting total of debit and credit postings, and as each amount is checked, check the balance with the amount transferred to the trial balance sheets.

Look through books of original entry for amounts which, incorrectly posted, might make the difference. For example, if the difference is $1.80 the following might apply:

An item of $1.80 not posted or posted twice or posted in previous month and not included in the balance.

An item of $0.90 on the wrong side. This applies only to differences divisible by two.

ORIGINATING ORGANIZATION 61 DATE June 30, 1927 JOURNAL ENTRY NO. 21

DETAILED CLASSIFICATION	CHARGED BY	ACCOUNTS NO.	ACCOUNTS NAME	DEBITS	✓	CREDITS	✓
Details on file Dept 61		2	BUILDINGS				
		3	PERMANENT FIXTURES				
		4	MACHINERY*				
		5	SMALL TOOLS				
		6	PATTERNS*				
		7	FURNITURE AND FIXTURES*				
	APMR	8	FOUNDRY WORKS EXPENSE*	863 75 38	✓		
		10	PLANT IN PROCESS				
		28	INTERHOUSE ADJUSTMENT				
		35	SHOP MERCHANDISE				
		36	SHOP PRODUCTIVE LABOR				
		37	SHOP RAW MATERIAL				
		45	SHOP DELIVERIES				
		46	SHOP OUTPUT				
		48	SHOP SCRAP				
		63	DEVELOPMENT EXPENSE				
	HA	70	GENERAL EXPENSE	1738 71	✓		
		78	ACCOUNTS RECEIVABLE—SHOP CUSTOMERS				
		88	ACCRUED INTEREST				
		97	ACCRUED RENT				
		98	ACCRUED INSURANCE				
		99	ACCRUED TAXES				
		108	WESTERN ELECTRIC INVESTMENT				
		108-201	HAWTHORNE WORKS				
		108-195	BROADWAY				
	HA	118	ACCRUED DEPRECIATION ON PLANT			89219 81	✓
		143	ACCOUNTS RECEIVABLE—EMPLOYEES ACCOUNTS				
		145	ACCOUNTS PAYABLE—SUPPLIER				
*ENTRIES AFFECTING THESE ACCOUNTS SHALL BE ACCOMPANIED BY N.W.E. SHOWING BRANCH LEDGER ACCOUNTS.		147	ACCOUNTS PAYABLE—PAY ROLL				
	MA	54	Merchandising Expense	1105 72	✓		

DESCRIPTION Accrued Depreciation on plant for fiscal month of June 1927

PRELIMINARY APPROVAL (INITIALS) FINAL APPROVAL (FULL SIGNATURE) D J Pfeifer

Fig. 8.

An item of $2.00 posted as $0.20 or *vice versa*.

The amount may have been transposed in posting. For example: $7.50 posted as $5.70 or *vice versa*. This applies only to differences divisible by nine.

Check amounts of journal entries distributing sales and purchases, with totals of recapitulation sheets, and check other journal entries to see that total of debits and credits are equal.

Check postings.

Check additions of books of original entry and recapitulation sheets, paying particular attention to totals carried forward.

March 16 1927 ISSUE 45

TRIAL BALANCE

AT February 28 1927

		ANALYSIS OF ACCOUNT 10	(A) DEBIT BALANCE	(B) CREDIT BALANCE
PLANT				
1	GROUNDS		1241993 83	
2	BUILDINGS	585111 12	8864630 91	
3	PERMANENT FIXTURES	469805 0	3976565 02	
4	MACHINERY	166857 54	4493441 04	
5	SMALL TOOLS	831 17	396684 96	
6	PATTERNS		9835	
7	FURNITURE AND FIXTURES	81438 68	882252 31	
10	PLANT IN PROCESS		354619 01	
	TOTAL		20210279 43	
MERCHANDISE				
21	MERCHANDISE INVENTORY			
26	INTRA COMPANY SUSPENSE ACCOUNT		28851 9	
	TOTAL		28851 9	
SHOP MERCHANDISE				
9	MANUFACTURING EXPENSE		914167 78	
35	SHOP MERCHANDISE		660013 00	
36	PRODUCTIVE LABOR		482207 88	
37	RAW MATERIAL		3771992 23	
45	SHOP DELIVERIES			379359 56
46	SHOP OUTPUT		27461 26 82	
48	SCRAP		3289 19	
	TOTAL		4784201 34	
EXPENSE				
53	DEVELOPMENT EXPENSE		8882 5	
70	GENERAL EXPENSE		81528 18	
71	INTEREST			1055 50
	TOTAL		81360 93	
CASH				
75	CASH		15616 96	
	TOTAL		15616 96	
RECEIVABLES				
76	BILLS RECEIVABLE			
78	ACCOUNTS RECEIVABLE EXCEPT BELL TELEPHONE COMPANIES		9983 17	
79	DOUBTFUL RECEIVABLES			
80	EMPLOYEES' PERSONAL LOANS			
81	EMPLOYEES' HOME LOANS		1069 47	
83	EMPLOYEES' ACCOUNTS		1078 79	
87	TRANSPORTATION CLAIMS		184 56	
88	IMPORT DUTY DRAWBACK			
89	MISCELLANEOUS ACCOUNTS RECEIVABLE			
Turner Construction (Advance Account)			3511 8 03	
98	ACCRUED INTEREST			
	TOTAL		6843 7 96	

FIG. 9a.

March 16 1927 ISSUE 45

TRIAL BALANCE

AT February 28 1927

	(A) DEBIT BALANCE	(B) CREDIT BALANCE
CAPITAL LIABILITIES		
106 WESTERN ELECTRIC INVESTMENT		22262257 51
TOTAL		22262257 51
CURRENT LIABILITIES		
97 ACCRUED RENT	490 48	
98 ACCRUED INSURANCE	288 66 11	406 74 00
99 ACCRUED TAXES		
138 MATERIAL CONSIGNED TO SUPPLIERS (B)	2645 94	
145 SUPPLIERS' ACCOUNTS		358 22 10
147 PAY ROLL		955 37 14
148 UNCALLED FOR PAY		19 96 90
149 OUTSTANDING CHECKS		78 75
160 MISCELLANEOUS ACCOUNTS PAYABLE		
154 EMPLOYEES' DEPOSITS FROM PAY		3 00
167 EMPLOYEES' STOCK PURCHASES		
TOTAL		4645 11 36
DEPRECIATION AND OTHER RESERVES		
117 DEPRECIATION ON PLANT		2359195 78
118 ACCRUED DEPRECIATION ON PLANT		217819 27
121 DEPRECIATION ON RECEIVABLES		143 85
TOTAL		2576558 94
GRAND TOTAL (A)	25303327 81	25303327 81

NOTES (A) THE LEDGERS ARE {IN / ~~OUT OF~~} BALANCE, DIFFERENCE INCLUDED WITH SUPPLIERS' ACCOUNTS 145 $ _____

(B) DIVISION OF ACCOUNT 138:— PLANT

4 ACC'T $ _____
5 " 1475.00
6 " 1170.94
7 " _____
OTHER _____

TOTAL $ 2645.94

COPIES TO:— Comptroller - N.Y.
Supt. Operating Statistics - N.Y.
21 990 61 65
68 60-1 60-2 60

_____ ACCOUNTANT

NEXT REPORT DUE Apr. 20, 1927

FIG. 9b.

Check additions of trial balance sheets, or, where footings have been secured by using an adding machine, make sure that the machine was cleared before listing was started.

The journal entries and trial balances of such a company are designed of course, to save all possible time. Hence there is found a *printed form* for the journal entry (see Fig. 8), one form being used for each entry. The trial balance is also a printed form in which the figures are merely filled in (see Fig. 9). These are merely labor- and time-saving schemes which necessarily arise as the organization grows. They in no way violate the fundamentals developed and are shown to give the reader the practical side of the work.

In the following problem, the accounting points emphasized are:

1. Opening balance sheet
2. Opening journal entries
3. Journalizing and posting
4. The two methods of taking a trial balance

Problem 1.

It may be assumed for the purpose of illustrating bookkeeping procedure, the transactions which happened in the machine supply business of J. F. Thompson during the month of January, 1927. The transactions will be few in number, but they will typify the thousands of specific transactions which, as a matter of fact, would happen in practice.

On Jan. 1, 1927, J. F. Thompson had $15,000 of cash available—$500 on hand and $14,500 on deposit in bank. He had merchandise stock on hand valued at $9,500. He owned furniture and fixtures which he had bought on May 1, 1926, from D. Clarke & Company, for $3,000. He had paid $1,500 in cash on account of the furniture and fixtures and had given a promissory note for $1,500 to D. Clarke & Company, dated May 1, 1926, due in 9 months, interest at 6%, for the balance. The furniture and fixtures were valued, on Jan. 1, 1927, at cost, $3,000.

a. Draw up a balance sheet for opening double-entry books.
b. Make opening journal entries on the basis of this statement.
c. Journalize the following given below.
d. Open the necessary ledger accounts and post the journal entries thereto.
e. Take off a trial balance of the ledger accounts using both methods.

Jan. 2. Purchases $1,700 merchandise, for cash.
4. Purchases $2,800 merchandise from Drew and Co., on account.
6. Paid Drew and Co. bill of Jan. 4 by cash, $2,800.
7. Sells $1,050 merchandise for cash.
9. Sells $1,600 merchandise to Berry Bros., on account.
10. Sells $800 merchandise to J. B. Berling, on account.
11. Receives check from Berry Bros. for payment of bill of Jan. 9, $1,600.
12. Pays rent, $250, for month of January.

31. Pays $1,500 note, with interest, totaling $1,567.50.

J. F. THOMPSON

Balance Sheet
as of Jan. 1, 1927

Assets		=	Liabilities	+	Capital
Cash:			Notes Payable		$ 1,500.00
On hand	$ 500.00		[1]Accrued Interest		60.00
In bank	14,500.00	$15,000.00			
Merchandise Inventory		9,500.00	J. F. Thompson, Capital		25,940.00
Furniture and Fixtures		3,000.00			
		$27,500.00			$27,500.00

BOOKS OF J. F. THOMPSON
Journal — Journal page 1

1927								
Jan.	1	Cash						
		on hand	L-1	$ 500	00			
		in bank	L-1	14,500	00			
		Merchandise Inventory	L-1	9,500	00			
		Furniture and Fixtures	L-1	3,000	00			
		Notes Payable	L-2			$ 1,500	00	
		Accrued Interest	L-2			60	00	
		J. F. Thompson, Capital	L-2			25,940	00	
		To bring onto the books the value of the assets, liabilities and capital of J. F. Thompson upon beginning business on Jan. 1, 1927[2]						
				$27,500	00	$27,500	00	
Jan.	2	Purchases	L-3	$ 1,700	00			
		Cash	L-1			$ 1,700	00	
		To record the purchase of merchandise for cash						
	4	Purchases	L-3	2,800	00			
		Drew and Company	L-2			2,800	00	
		To record the purchase of merchandise on account						
	6	Drew and Company	L-2	2,800	00			
		Cash	L-1			2,800	00	
		To record the payment of Drew and Company account of Jan. 4						

[1] Since the interest on the note has been accumulating for 8 months before the books are opened, the firm is liable for the interest which has accumulated; and this amount is carried on the books as *Accrued Interest* which is a *Current Liability.*

[2] This type of journal entry is used to bring the values as found on the initial balance sheet onto the journal and ledger.

Journal page 2

1927									
Jan.	7	Cash	L-1	$	1,050	00			
		Sales	L-3				$	1,050	00
		To record the sale of merchandise for cash							
	9	Berry Bros.	L-1		1,600	00			
		Sales	L-3					1,600	00
		To record the sale of merchandise to Berry Bros. on account							
	10	J. Berling	L-1		800	00			
		Sales	L-3					800	00
		To record the sale of merchandise to J. Berling on account							
	11	Cash	L-1		1,600	00			
		Berry Bros.	L-1					1,600	00
		To record the payment by Berry Bros. of their account of Jan. 9							
	12	Rent	L-3		250	00			
		Cash	L-1					250	00
		To record the payment of rent for the month of January							

Journal page 3

1927									
Jan.	31	Notes Payable	L-2	$	1,500	00			
		Accrued Interest[1]	L-2		60	00			
		Interest Expense[1]	L-3		7	50			
		Cash	L-1				$	1,567	50
		To record the payment of the note of May 1, 1926 bearing interest at 6%							

[1] Since the interest due up to Jan. 1 and the amount due during January has now been paid off, the accrued interest account is closed out and the interest expense for the month is charged as a temporary proprietorship outgo.

The subject of accrued items is fully treated in Chap. VI.

Books of J. F. Thompson

Ledger

Cash

Ledger page 1

1927						1927					
Jan.	1	On hand	J-1	$ 500	00	Jan.	2	Merchandise Purchase	J-1	$ 1,700	00
		In bank	J-1	14,500	00		6	Drew & Co. acc.	J-1	2,800	00
	7	Sales	J-2	1,050	00		12	Rent	J-2	250	00
	11	Berry Bros.	J-2	1,600	00		31	Payment of note	J-3	1,567	50
								Balance		11,332	50
				$17,650	00					$17,650	00
	31	Balance Forward		$11,332	50						

Merchandise Inventory

1927					
Jan.	1	To begin business	J-1	$ 9,500	00

Furniture and Fixtures

1927					
Jan.	1	To begin business	J-1	$ 3,000	00

Berry Bros.

1927						1927					
Jan.	9	Sale Merchandise	J-2	$ 1,600	00	Jan.	11	Payment of account	J-2	$ 1,600	00
				$ 1,600	00					$ 1,600	00

J. Berling

1927					
Jan.	10	Sale Merchandise	J-2	$ 800	00

Ledger page 2

Notes Payable

1927						1927					
Jan.	31	Payment of note at 6%	J-3	$ 1,500	00	Jan.	1	6% due Feb. 1	J-1	$ 1,500	00
				$ 1,500	00					$ 1,500	00

Accrued Interest

1927						1927					
Jan.	31	Payment of note 6% on $1,500	J-3	$ 60	00	Jan.	1	Int. accrued at 6% on $1,500	J-1	$ 60	00
				$ 60	00					$ 60	00

Drew and Company

1927						1927					
Jan.	6	To pay on account	J-1	$ 2,800	00	Jan.	4	Mdse. Purchase	J-1	$ 2,800	00
				$ 2,800	00					$ 2,800	00

J. F. Thompson, Capital

						1927					
						Jan.	1	To begin business	J-1	$25,940	00

Ledger page 3

Sales

1927						1927					
						Jan.	7	Cash	J-2	$ 1,050	00
							9	Berry Bros.	J-2	1,600	00
	31	Balance		$ 3,450	00		10	J. Berling	J-2	800	00
				$ 3,450	00					$ 3,450	00
								Balance forward		3,450	00

Purchases

1927						1927					
Jan.	2	For cash	J-1	$ 1,700	00						
Jan.	4	Drew and Company	J-1	2,800	00	Jan.	31	Balance		$ 4,500	00
				$ 4,500	00					$ 4,500	00
		Balance forward		$ 4,500	00						

Rent

1927											
Jan.	12	For month of January	J-2	$ 250	00						

Interest Expense

1927											
Jan.	31	6% on $1,500 for month of January	J-3	$ 7	50						

Trial Balance of Sums or Totals

	Dr.	Cr.
Cash	$17,650 00	$ 6,317 50
Merchandise Inventory	9,500 00	
Furniture and Fixtures	3,000 00	
Berry Bros.	1,600 00	1,600 00
J. Berling	800 00	
Notes Payable	1,500 00	1,500 00
Accrued Interest	60 00	60 00
Drew and Company	2,800 00	2,800 00
J. F. Thompson, Capital		25,940 00
Sales		3,450 00
Purchases	4,500 00	
Rent	250 00	
Interest Expense	7 50	
	$41,667 50	$41,667 50

Trial Balance of Differences

Cash	$11,332 50	
Merchandise Inventory	9,500 00	
Furniture and Fixtures	3,000 00	
J. Berling	800 00	
J. F. Thompson, Capital		$25,940 00
Sales		3,450 00
Purchases	4,500 00	
Rent	250 00	
Interest Expense	7 50	
	$29,390 00	$29,390 00

SUMMARY

In Chap. IV, the following accounting points were emphasized:

1. The basic books in double entry are (*a*) the journal in which the original chronological record of transactions, with debit and credit distinctions are made and (*b*), the ledger, in which the accounts are kept, and to which postings are made from the journal.

2. A listing of the accounts is made at the end of each period to obtain a view of the ledger and to check the mathematical accuracy of the books.

3. This listing is known as a "trial balance" and may be taken by one of two methods—the method of totals or the method of balances.

CHAPTER V

ACCOUNT CLASSIFICATION

OBJECT OF CHAPTER: (*a*) to enlarge upon account classification; (*b*) to give further definitions and practical examples from industry.

Major Division of Accounts.

Accounts are generally divided into three major classes—real accounts (assets, liabilities, and capital), nominal accounts (income and expense), and mixed accounts, which contain both the real and nominal elements. An amplification of these accounts results in the following chart (see Fig. 10).

Current and Fixed Assets.

Before proceeding further, the terms, "current" and "fixed," as applied to assets, will be defined.

The following outlines give several points of difference which cover most cases.[1]

1. Length of life in business:
   - *a.* Current assets will normally remain less than 1 year and at the most 2 years in the business. Examples: materials, cash, accounts receivable, etc.
   - *b.* Fixed assets remain an economic factor for at least 2 and usually 5 or more years. Examples: land, buildings, machinery, office furniture, delivery equipment, long-term securities, leaseholds, etc.
2. Liquidity.
   - *a.* Current assets are those which will shortly be converted into cash. Examples: Accounts Receivable; Notes Receivable.
   - *b.* Fixed assets are those which may or can only with difficulty or in a roundabout fashion be converted into cash. Example: a unit of equipment.
3. Rapidity of transformation into expense or cost of sales.
   - *a.* Current assets are those which are very shortly converted into expense or cost of sales. Example: the direct

[1] PATON, W. A., "Accounting," p. 259.

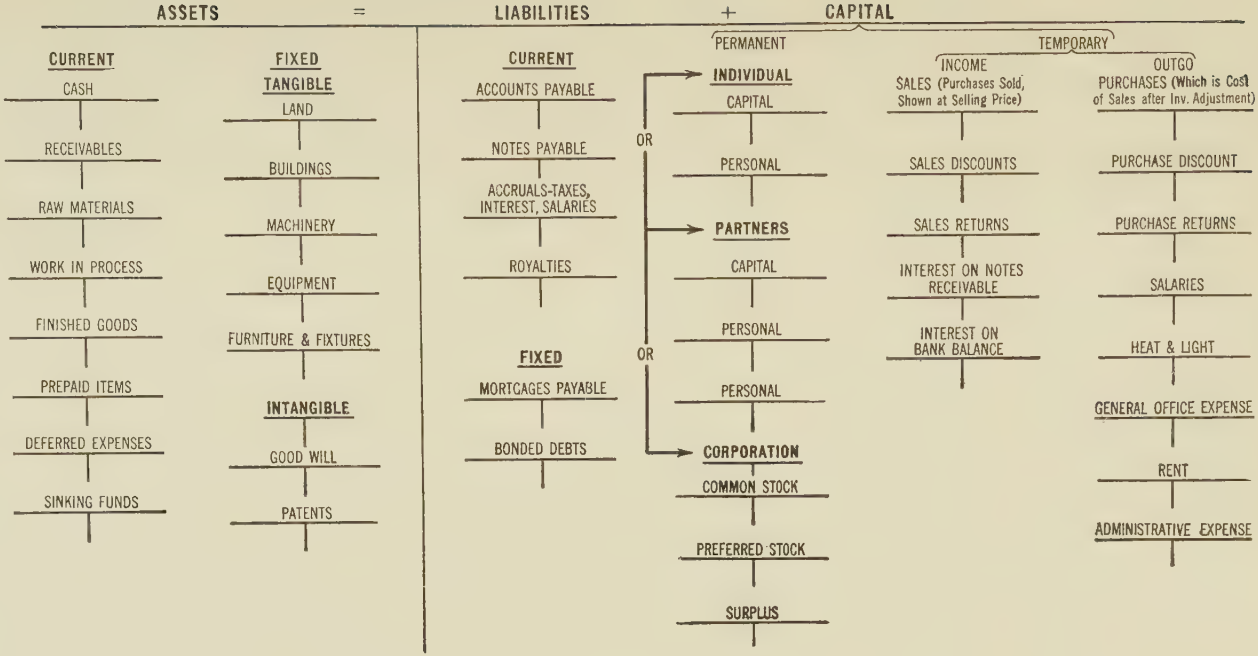

ASSETS
=
LIABILITIES
+
CAPITAL
CURRENT
CASH
RECEIVABLES
RAW MATERIALS
WORK IN PROCESS
FINISHED GOODS
PREPAID ITEMS
DEFERRED EXPENSES
SINKING FUNDS
FIXED
TANGIBLE
LAND
BUILDINGS
MACHINERY
EQUIPMENT
FURNITURE & FIXTURES
INTANGIBLE
GOOD WILL
PATENTS
CURRENT
ACCOUNTS PAYABLE
NOTES PAYABLE
ACCRUALS-TAXES, INTEREST, SALARIES
ROYALTIES
FIXED
MORTGAGES PAYABLE
BONDED DEBTS
OR
OR
PERMANENT
INDIVIDUAL
CAPITAL
PERSONAL
PARTNERS
CAPITAL
PERSONAL
PERSONAL
CORPORATION
COMMON STOCK
PREFERRED STOCK
SURPLUS
TEMPORARY
INCOME
SALES (Purchases Sold, Shown at Selling Price)
SALES DISCOUNTS
SALES RETURNS
INTEREST ON NOTES RECEIVABLE
INTEREST ON BANK BALANCE
OUTGO
PURCHASES (Which is Cost of Sales after Inv. Adjustment)
PURCHASE DISCOUNT
PURCHASE RETURNS
SALARIES
HEAT & LIGHT
GENERAL OFFICE EXPENSE
RENT
ADMINISTRATIVE EXPENSE

FIG. 10.

material going into a product. The gear blanks for an automobile transmission furnish a good illustration.

b. Fixed assets are those that are very slowly converted into expense by a depreciation plan, as, for example, a milling machine in the shop.

Deferred Assets or Prepaid Charges (Deferred Charges to Operation).

Items such as unexpired insurance, prepaid advertising, prepaid rental, etc. are properly classified on the Balance Sheet as "deferred assets." While they are sometimes referred to as "current deferred assets," they should *not* be included in the current ratio (see Chap. XIX).

Intangible Assets.

Engineers and accountants are not wholly agreed as to the characteristics of this group, but the large percentage of common practice restricts the intangible class to such items as patents, copyrights, goodwill, etc.

Current and Fixed Liabilities.[1]

In this case, the classification depends largely on the maturity date of the liability and the problem is one of *length of life.* Under *fixed liabilities* may be included those which do *not* mature within a year and all other liabilities include those items which mature within a year. This latter type is again divided as the following outline will show.

1. Current liabilities are those that would normally be *paid off with cash,* and include such items as accounts payable, notes payable, accrued salaries, accrued interest payable, dividends declared but not yet paid, etc.

2. Fixed liabilities, for example, would include such items as mortgages, debenture, long-term obligations, etc.

3. Deferred liabilities are those that are usually paid off with services or products. They are, nevertheless, due within a year, and may be paid in cash, particularly in case of bankruptcy. Hence, they fall in the *current class.* Since they mature at an early date they *should* be included in the current ratio (see Chap. XIX).

[1] KREBS, W. S., "Outlines of Accounting," Vol. II.

The total of the current obligations are sometimes called the "floating debt" of the company, while the sum of the fixed liabilities is known as the "funded debt."

Account Classification of a Manufacturing Plant.

To illustrate these principles, the following accounts are included in the account classification chart of one of our largest eastern manufacturing plants.

Account 1. *Grounds.*—This account includes the amounts paid for the grounds, and legal expenses in connection with title cost of surveys and borings. Also, includes amounts paid to the public authorities for improvements, such as street pavements, sidewalks, parking, sewers, etc., not located on the property of the company.

Account 2. *Buildings.*—To this account shall be charged the cost of all permanent buildings and other similar plant structures. Includes such items as follows: buildings proper, excavations and filling, walks, drives, and subways, general sewer systems, etc.

Account 3. *Permanent Fixtures.*—Fixtures and machinery not part of the building which would not be moved ordinarily if the buildings were vacated or if changes were made in productive work carried on within the buildings.

Includes such items as steam generating and distributing systems, electric current generating and power distributing systems, illuminating, compressed air, telephone, gas and water supply systems, heating system, elevators and plumbing, etc.

Account 4. *Machinery.*—In general, charged with items falling under the definition of a combination of mechanical parts, serving to transmit or modify, and, in some cases, to measure force or motion so as to produce some given effect or to do work. Certain arbitrary distinctions are made by the company. The Machinery account includes that machinery used directly in connection with the work of one or a group of productive departments. As a rule, that machinery that would not be moved with a productive department or group of productive departments is charged to the Permanent Fixture account. Machines used as office appliances are classified in the Furniture and Fixture account.

Consists of such items as motors, generators, cranes, locomotives, certain ovens, furnaces, lathes, presses, blowers, fans, lead presses, stranders, twisters, etc.

Account 5. *Small Tools.*—Items charged to this account are those such as may be defined in a general way as an instrument or implement for manual or machine operation used in cutting, forming, measuring, building, holding, etc. In general, only the more expensive and more permanent tools are included in this account, the others being considered expense tools and charged to the Expense account.

Tools purchased with and as a part of machines are charged to the Machine account with the machines.

Examples of tools charged to this account are as follows: acetylene welding outfits, anvils, chucks, clamps, brazing outfits, gas stoves, electric and air

hammers, racks (lacquering, painting, plating), tongs, tool rests, vises, wrenches (opening over 2 inches), wringers, etc.

Account 6. *Patterns.*—A pattern charged to this account may be defined as the model, in one or more parts, used in forming the sand mold into which molten metal is poured to form a casting, including master patterns, metal, and other wood patterns and sweeps. The account shall also be charged with patterns used with other than sand and for producing castings other than metal and shall include core boxes whether of metal or wood. It shall not include die blocks which themselves are the molds from which the casting is formed and are included in the Small Tools account.

Account 7. *Furniture and Fixtures.*—All furniture, office appliances, and fixtures other than those used directly in manufacturing operations which would be moved if a department were moved or a building vacated. This includes such items as chairs, desks, lockers, wall clocks, filing units, addressing and calculating machines, typewriters, etc.

The foregoing accounts are charged with plant items made or purchased at the purchase price or cost to make and are credited only when the item is sold or scrapped.

The Merchandise accounts consist of the following:

Account 26. *Productive Labor.*—The balance in this account each month represents the total payroll of employees engaged in operations which produce a definite or tangible product.

Account 9. *Works Expense.*—Expenditures, including the depreciation on plant investment, not assessable against definite jobs but common to all or a number of jobs. Overhead cost of conducting the business.

Account 37. *Raw Material.*—This account is charged at actual purchase price value of all raw material proper or that material which enters directly into the product and may be accounted for in a comprehensive analysis of the finished article. It is also charged with the purchase value of supplies and piece parts purchased from suppliers.

Account 45. *Shop Deliveries.*—This account is credited with the cost of all work performed, labor, material, and loadings. (Loadings being the medium for liquidating expense.)

Account 46. *Shop Output Account.*—This account is charged principally with the value of work done on the shop and piece parts purchased.

It is credited with the value of the product delivered to the merchandise branch. It includes the inventory of piece parts.

Account 48. *Shop Scrap Account.*—Scrap consists of raw material which remains after manufacturing processes, the form of which is such that it can be disposed of only for its intrinsic value.

It also includes material taken from finished or partially finished products no longer serviceable which cannot be returned to stock for re-use.

Others of the more commonly used accounts are the following:

Account 70. *General Expense Account.*—Charges include expenses of the following organizations:

Executive.

Engineering department.

General Accounting department.

General Purchasing department.

General Traffic department.
Legal department.
Publicity department.
Supply Sales department.
Treasury department.

Account 75. *Cash Account.*—This is the controlling account for cash received and disbursed.

Account 97. *Accrued Rent.*

Account 98. *Accrued Insurance.*

Account 99. *Accrued Taxes.*

These accounts are designed to adjust to the proper fiscal period by monthly allotments, payments for rent, insurance, and taxes.

For example, insurance is usually paid in advance to cover a period of years. The total amount paid is charged to the insurance account which is credited monthly for the portion that is chargeable to the expense of that period. The balance at any time is an asset on the company books representing insurance paid, not accrued.

Classification of Indirect Manufacturing Expense.

As a further illustration of account classification, the "Classification of Indirect Manufacturing Expense" of the National Electrical Manufacturers Association[1] is shown beginning on page 54.

The selection of one of the following groups of subaccounts is optional, depending upon requirements. For very small companies, the "condensed accounts" may afford sufficiently detailed data, for larger ones, the "subaccounts" or the "further subdivisions" may be required. Collective subaccounts and subdivisions are provided for the entire expense of some departments, such as purchasing, receiving, storekeeping, and shipping, the use of which is optional. The alternative is to use symbols to indicate the departmental distribution, and classify the expense according to its character, as in the case of other manufacturing departments. A separate group of accounts is provided for all power-plant expense.

[1] Taken from "Standard Accounting and Cost System for Electrical Industry," National Electrical Manufacturer's Association.

CLASSIFICATION OF INDIRECT MANUFACTURING EXPENSE

Condensed Accounts	Subaccounts	Further Subdivisions
200. Salaries and wages	210. Supervision	211. Supervision
		212. Foremen and Assistants
		213. Inspectors
	220. Clerical Employees	221. Clerical Employees
	230. Service Employees	231. Elevator and Crane Operators
		232. Stockkeepers and Helpers
		233. Tool Crib Attendants
		234. Helpers and Laborers
		235. Railway Employees
		236. Chauffeurs and Garagemen
240. Operating Supplies	240. Operating Supplies	241. Fuel Consumed
		242. Non-durable Tools
		243. Shop Supplies
		244. Inspection and Supplies, (lighting and electrical equipment)
		245. Office Supplies
	260. Industrial Service	261. Accident Service
		262. Hospital Service
		263. Employees Educational Work
		264. Employees Representation
		265. Employees Suggestion Awards
		266. Employment Bureau
		267. Industrial Service Research
		268. Restaurant Operations
		269. General Welfare
	270. Unassignable Transportation and Packing (incoming)	271. Unassignable Transportation and Packing (incoming)
	280. Packing (outgoing)	281. Packing (outgoing)

CLASSIFICATION OF INDIRECT MANUFACTURING EXPENSE.—(*Continued*)

Condensed Accounts	Subaccounts	Further Subdivisions
250. Other Manufacturing Expense	290. Shop Losses.....	291. Defective Workmanship
		292. Defective Purchased Material
		293. Other Losses Due to Errors
	300. Other Manufacturing Expense	301. Rearrangement of Equipment
		302. Telephone and Telegraph
		303. Traveling Expenses
		304. Plant Protection
		305. Grounds and Gardens
		306. Instruction of Apprentices
		307. Other Manufacturing Expense
	310. Purchasing, Receiving, Storekeeping, and Shipping (optional)	311. Purchasing Department
		312. Receiving Department
		313. Storekeeping Department
		314. Shipping Department
320. Power, Heat, and Light (producing)	330. Operating Employees	331. Supervision
		332. Clerical Employees
		333. Service Employees
	340. Operating Supplies	341. Fuel Consumed
		342. Steam
		343. Water
		344. Lubricants
		345. Non-durable Tools
		346. Other Supplies

MAINTENANCE ACCOUNTS

Condensed Accounts	Subaccounts	Further Subdivisions
320. Power, Heat, and Light (producing)	350. Other Operating Expense	351. Other Operating Expense
	360. Maintenance....	361. Buildings
		362. Steam Plant
		363. Engines and Turbines
		364. Electrical Plant
		365. Other Maintenance
	370. Fixed Charges...	371. Depreciation
		372. Taxes
		373. Insurance
		374. Rentals
		375. Assessed Charges
380. Power, Heat, and Light (purchased)	380. Power, Heat, and Light (purchased)	381. Power, Heat, and Light (purchased)
400. Maintenance, Buildings	410. Buildings and Structures	411. Office Buildings
		412. Other Buildings
		413. Structures
	420. Piping and Wiring (outside)	421. Outside Underground Piping and Electrical Conductors
		422. Other Outside Piping and Electrical Conductors
	430. Piping and wiring (inside)	431. Sprinkler System
		432. Heating and Ventilating System
		433. Other Inside Piping
		434. Inside Electrical Wiring and Conductors
	450. Machinery.....	451. Machinery
		452. Electrical Apparatus
		453. Ovens, Furnaces, and Vats
		454. Foundations

MAINTENANCE ACCOUNTS.—(*Continued*)

Condensed Accounts	Subaccounts	Further Subdivisions
440. Maintenance, Machinery, and Tools	460. Tools and Instruments.	461. Semidurable Tools
		462. Electrical Equipment
		463. Molds, Jigs, Punches, Dies, and Special Tools
		464. Metal Flasks
470. Maintenance, Furniture and Fixtures	480. Factory Fixtures and Equipment	481. Factory Fixtures and Equipment
	490. Furniture and Appliances	491. Furniture and Appliances
	500. Patterns.....	501. Patterns
510. Maintenance, Transportation System	520. Transportation System	521. Roads, Driveways, and Sidewalks
		522. Railway Tracks and Overhead Equipment
		523. Rolling Stock
		524. Automobiles and Electric Trucks
		525. Other Conveyances
	FIXED CHARGES	
530. Fixed Charges	540. Depreciation....	541. Depreciation
	550. Taxes.....	551. Taxes
	560. Other Fixed Charges	561. Insurance(property)
		562. Rentals
		563. Accident Compensation
		564. Shop Vacation Allowance
		565. Group Insurance
		566. Supplementary Compensation
		567. Taking Inventories
		568. Establishment Charges Liquidated
		569. Pensions
580. Expense Credits	570. Assessed Charges	571. Assessed Charges
	580. Expense Credits	581. Expense Credits

C. P. A. Classification Problem and Its Solution.

The following Wisconsin C. P. A. problem and its solution will further aid in enlarging the knowledge of account names and classifications developed to the present time.

The problem is to classify and group the following accounts of a manufacturing company according to kind of *asset*, *liability*, *income*, and *expense*.

1. Accounts Payable
2. Accounts Receivable
3. Accrued Salaries and Wages
4. Advertising
5. Bad Debts Written off
6. Bills Payable
7. Bills Receivable
8. Bond Discount
9. Bond Premium
10. Bond Interest Accrued
11. Capital Stock
12. Cash
13. Credit Department Expense
14. Depreciation Buildings, Machinery, and Plant
15. Depreciation of Workmen's Cottages
16. Directors' Fees
17. Discount on Purchases
18. Discount on Sales
19. Federal Corporation Tax
20. First Mortgage bonds
21. Freight and Cartage, inward
22. Freight and Cartage, outward
23. General Office Expense
24. Goodwill
25. Insurance
26. Insurance Premiums, unexpired
27. Interest on Bills Payable
28. Interest on Bonds
29. Income from Investments
30. Inventory Raw Material
31. Inventory, Goods in Process
32. Inventory, Manufacturers Goods
33. Investments Outside
34. Maintenance of Buildings, Machinery, and Plant
35. Maintenance of Workmen's Cottages
36. Manufacturing Power Heat, and Light
37. Miscellaneous Selling Expenses
38. Miscellaneous Factory Expenses
39. Non-productive Labor
40. Office Equipment
41. Office Salaries
42. Officer's Salaries and Expenses
43. Organization Expenses
44. Patent Rights
45. Patterns and Drawings
46. Plant Site
47. Plant Buildings
48. Plant, Machinery, and Equipment
49. Productive labor
50. Purchasing department, Expenses
51. Raw Materials Purchased
52. Rent from Workmen's Cottages
53. Reserve for Depreciation of Buildings, Machinery, and Plant
54. Reserve for Depreciation of Workmen's Cottages
55. Reserve for Doubtful Accounts
56. Reserve for Sinking Fund
57. Returns and Allowances on Purchases
58. Returns and Allowances on Sales
59. Sales of Manufactured Goods
60. Sales of Waste Material
61. Sales Agents' Commissions
62. Salesmen's Salaries
63. Salesmen's Expenses
64. Sinking Fund Investments
65. Surplus
66. Taxes on Plant and Equipment
67. Taxes Accrued
68. Workmen's Cottages

(Wisconsin C. P. A. Examination)

Solution

Assets

Fixed Assets:

Number	Item
46	Plant Site
47	Plant buildings
48	Plant, Machinery, and Equiment
68	Workmen's Cottages
40	Office Equipment

Fixed Assets, Intangible:

24	Goodwill
44	Patent Rights
45	Patterns and Drawings

Investments:

33	Investments (outside)
64	Sinking-fund Investments

Current Assets:

12	Cash
2	Accounts Receivable
7	Bills Receivable

Inventories:

30	Inventory, Raw Material
31	Inventory, Goods in Process
32	Inventory, Manufactured Goods

Deferred Charges and Prepaid Items:

43	Organization Expenses
26	Insurance Premiums Unexpired

Liabilities and Capital

Fixed Liabilities:

20	First-mortgage bonds

Current Liabilities:

1	Accounts Payable
6	Bills Payable

Accrued Items:

3	Accrued Salaries and Wages
10	Bond Interest Accrued
67	Taxes Accrued

Reserves:

53	Reserve for Depreciation of Buildings, Machinery, and Plant
54	Reserve for Depreciation of Workmen's Cottages
55	Reserve for Doubtful Accounts
56	Reserve for Sinking Fund

Capital:

11	Capital Stock
65	Surplus

Income and Expense

Manufacturing Cost Accounts:
- 49 Productive Labor
- 51 Raw Materials Purchased (after elimination of inventory)
- 21 Freight and Cartage, inward
- 57 Returns and Allowances on Purchases
- 50 Purchasing department, Expenses

Manufacturing Expenses:
- 39 Non-productive Labor
- 34 Maintenance of Buildings, Machinery, and Plant,
- 36 Manufacturing Power, Heat, and Light
- 66 Taxes on Plant and Equipment
- 25 Insurance
- 14 Depreciation on Buildings, Machinery, and Plant
- 38 Miscellaneous Factory Expenses

Deductions from Manufacturing Cost:
- 60 Sales of Waste Material

Trading Accounts:
- 59 Sales of Manufactured Goods
- 58 Returns and Allowances on Sales

Selling Expenses:
- 4 Advertising
- 62 Salesmen's Salaries
- 61 Sales Agents' Commissions
- 63 Salesmen's Expenses
- 13 Credit Department, Expenses
- 22 Freight and Cartage, outward
- 37 Miscellaneous Selling Expenses

General Administrative Expenses:
- 42 Officers' Salaries and Expenses
- 16 Directors' Fees
- 41 Office Salaries
- 23 General Office Expenses
- 15 Depreciation of Workmen's Cottages
- 35 Maintenance of Workmen's Cottages
- 19 Federal Corporation Tax

Deductions from Administrative Expenses:
- 52 Rent from Workmen's Cottages

Capital Expenses:
- 18 Discount on Sales
- 5 Bad Debts Written off
- 27 Interest on Bills Payable
- 8 Bond Discount
- 28 Interest on Bonds

Capital Income:
- 17 Discount on Purchases
- 29 Income from Investments
- 9 Bond Premium

SUMMARY

In Chap. V, the following accounting points were emphasized:

1. Current items usually remain active factors in the business 1 year or less, and not more than 2 years.

2. Fixed items usually remain at least 2 years and generally more than 5 years.

3. Intangible, deferred, and accrued items, while they may be classed as either fixed or current, present special problems, and hence should be segregated for analysis purposes.

CHAPTER VI

PROCEDURE AT THE END OF THE FISCAL PERIOD—ADJUSTING ENTRIES

OBJECT OF CHAPTER: (*a*) to illustrate the work sheet method of taking off statements; (*b*) to develop the seven usual types of adjusting entries and to show their entries on the work sheet, the journal, and the ledger.

The Work Sheet and Its Purpose.

It must be borne firmly in mind that the examples thus far have been very simple, and to get a practical conception of a business their number should be multiplied by two or three thousand. If such is the case, it would be found desirable to *prove* the entire process of taking off the statements before any adjusting or closing entries are made in the ledger. By means of a "work sheet" such a thing is made possible.

The work sheet, working sheet, or analysis sheet, as it is variously called, is a sheet, usually varying from six to ten columns, used entirely outside of the books themselves for the purpose of drawing up and proving the financial statements.

The eight-column work sheet is quite commonly used and to show its operation the following problem is solved in diagram form.

At the end of an accounting period there are real, nominal, and mixed accounts in the ledger. The work sheet sets up the trial balance of the ledger and separates the mixed elements into real and nominal items by its adjustment columns. It further provides for a tabulation of the real accounts and the nominal accounts which then are rearranged into the form of the conventional financial statements.

Problem 1.

Given the following trial balance of A. B. Jamison, as of Jan. 15, 19—. Using an eight-column work sheet make adjustments and take off statements.

A. B. Jamison
Trial Balance
Jan. 15, 19—

	Dr.	Cr.
Cash	$ 6,186.30	
Office Furniture	800.00	
Delivery Equipment	1,500.00	
Merchandise Inventory, Jan. 1, 19—	350.00	
J. R. Boyles		$ 487.25
A. B. Jamison, Capital		10,964.05
Purchases	5,395.00	
Sales		3,725.00
Rent	250.00	
Salaries	450.00	
General Expense	245.00	
	$15,176.30	$15,176.30

Final Inventory Jan. 15, 19—, $3,310.00.

Note.—In order to gain a better understanding of this problem it is advisable first to work it out in the diagrammatic ledger form.

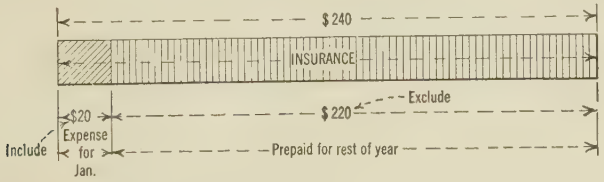
For solution of this problem see Fig. 11.

Comparison of One Accounting Period with Another.

In all accounting procedure the comparison of one accounting period with another is a very vital matter. The length of these periods is usually determined arbitrarily in keeping with what seems to be the best policy for the firm being considered. Thus, if the monthly period is used, it will be the desire of the managing executive to compare one month with another, *i.e.*, January, 1927, with January, 1926; or June, 1927, with July, 1927. With this need recognized, it becomes the duty of accountants to make it possible. In other words, accounts must be adjusted so that the nominal accounts are debited or credited only with *the exact amounts applicable to the period under consideration.*

Prepaid Insurance.

Example 1.—Insurance is paid 1 year in advance, $240. Statements are for month of January, 19—. Since the period under consideration is



Example 1*a*.

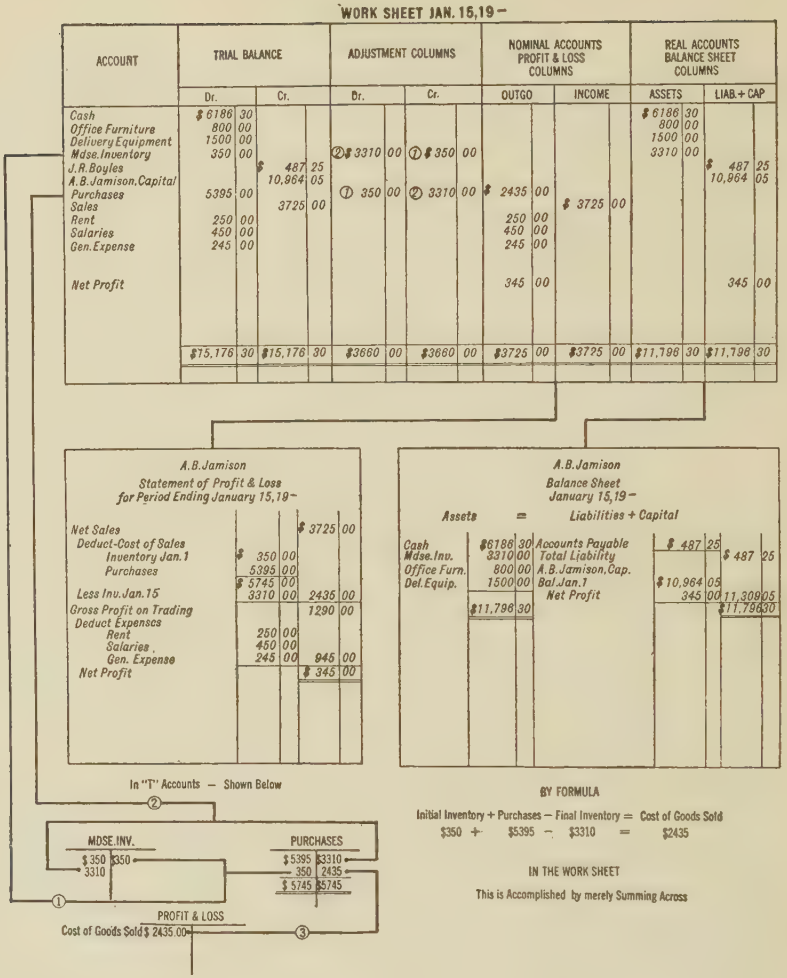
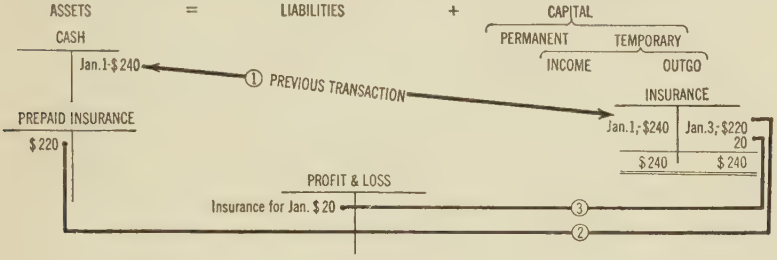

WORK SHEET JAN. 15,19—
ACCOUNT
TRIAL BALANCE
ADJUSTMENT COLUMNS
NOMINAL ACCOUNTS PROFIT & LOSS COLUMNS
REAL ACCOUNTS BALANCE SHEET COLUMNS
Dr.
Cr.
OUTGO
INCOME
ASSETS
LIAB.+ CAP
Cash $6186 30
Office Furniture 800 00
Delivery Equipment 1500 00
Mdse. Inventory 350 00
J.R. Boyles $ 487 25
A.B. Jamison, Capital 10,964 05
Purchases 5395 00
Sales 3725 00
Rent 250 00
Salaries 450 00
Gen. Expense 245 00
Net Profit
$15,176 30 $15,176 30
A.B. Jamison
Statement of Profit & Loss
for Period Ending January 15,19—
Net Sales $ 3725 00
Deduct-Cost of Sales
Inventory Jan. 1 $ 350 00
Purchases 5395 00
$ 5745 00
Less Inv. Jan. 15 3310 00 2435 00
Gross Profit on Trading 1290 00
Deduct Expenses
Rent 250 00
Salaries 450 00
Gen. Expense 245 00 945 00
Net Profit $ 345 00
A.B. Jamison
Balance Sheet
January 15,19—
Assets = Liabilities + Capital
Cash $6186 30
Mdse. Inv. 3310 00
Office Furn. 800 00
Del. Equip. 1500 00
$11,796 30
Accounts Payable $ 487 25
Total Liability $ 487 25
A.B. Jamison, Cap.
Bal. Jan. 1 $ 10,964 05
Net Profit 345 00
11,309 05
$11,796 30
In "T" Accounts — Shown Below
MDSE. INV.
$ 350 350
3310
PURCHASES
$ 5395 3310
350 2435
$ 5745 5745
PROFIT & LOSS
Cost of Goods Sold $ 2435.00
BY FORMULA
Initial Inventory + Purchases — Final Inventory = Cost of Goods Sold
$350 + $5395 − $3310 = $2435
IN THE WORK SHEET
This is Accomplished by merely Summing Across

FIG. 11.

the month of January, only $20 or one-twelfth of $240 will be charged to this period. The remainder, $220, is a deferred or prepaid value.

This example may be made clear by referring to the diagrammatic ledger and first noting the effect upon the temporary proprietorship account involved in the particular transaction.



Example 1*b*.

1. On Jan. 1, insurance was paid for the year, 1927. Debit Insurance and credit Cash.

2. On Jan. 31, upon taking inventory, it is realized only 1 month of Insurance has actually been "consumed." Eleven months, or $220, are paid in advance.

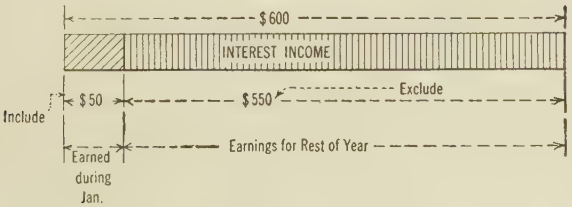
3. In making this adjustment the question to ask first is, "What is the effect upon the Insurance account?" The answer is evident, it is reduced by $220 and, therefore, a right entry or credit is made to accomplish this fact. The corresponding debit entry is to an account which is deferred to some future period for use, such as prepaid insurance.

While this procedure violates a common accounting rule which calls for the debit entry to be made first, it seems from the standpoint of logical deduction to be justified.

The $20 worth of insurance "consumed" is cleared into the Profit and Loss account, as shown, thus being charged to the expenses for January.

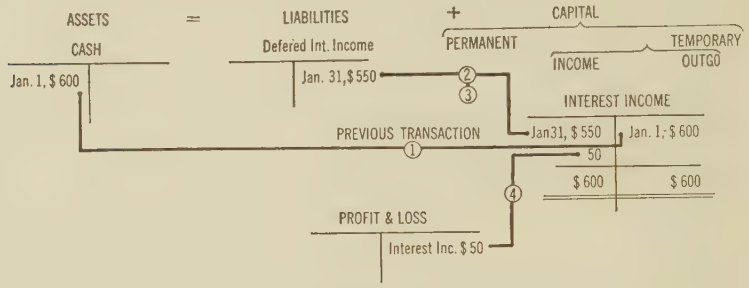
Deferred Interest Income.

Example 2.—Interest is received on notes 1 year in advance, $600. Statements are for month of January, 19—. In this illustration, $50 will be credited to this period as its earnings, and $550 will be credited in future periods as it is earned.



Example 2*a*.

If the same procedure be applied as to Example 1, its solution may be illustrated as follows:



Example 2*b*.

1. On Jan. 1, $600 interest is received in advance to pay the interest for the year, 19—. The entries are a debit to Cash and a credit (increase) to Interest Income.

2. On "taking inventory" on Jan. 31, it was realized that, having operated for only 1 month, just one-twelfth of the $600 paid in advance was earned, or $50. Consequently, the temporary proprietorship account interest income must be reduced by $550 and a new account be set up which registers liability for the money ($550) received *in advance* but *not earned*.

3. Therefore, debit Interest income and credit a liability account called Deferred Interest Income.

4. The $50 earned will be cleared into the Profit and Loss account as shown, contributing thus to the earning for January.

Hence, it may be said, adjusting requires the inclusion of certain income or expense items that affect the particular period under consideration. All others are *deferred* until later periods.

Seven Types of Adjustment Entries.

In the trading business there are seven types of adjusting entries:[1]

1. Merchandise Inventory Adjustment.
2. Deferred Expense items, for example, prepaid insurance.
3. Deferred Income items, for example, interest received but not yet earned.
4. Accrued Expense items, for example, accrued payroll.
5. Accrued Income items, for example, accrued interest (interest earned but not yet received).
6. Reserve for Depreciation.
7. Reserve for Loss on Accounts Receivable (bad debts).

[1] KESTER, R. B., "Accounting Theory and Practice," Vol. II, p. 237, 1922.

Let it be emphasized that the work sheet is merely an analysis sheet *outside* the books, which enables the accountant to make the adjustments mentioned and to prove the process by checking the two statements against each other. With this in mind, the adjustment entries must be brought on the books by means of the following procedure:

1. From the adjusting columns of the work sheet make corresponding debit and credit entries in the journal, thus journalizing the adjustments.
2. Post these to the ledger and rule off the accounts.

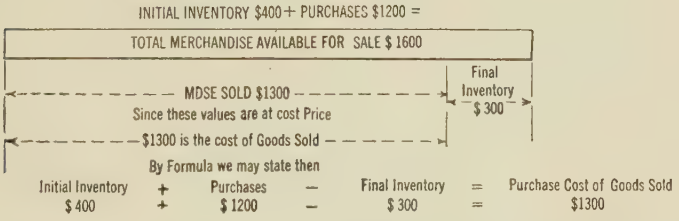
The following examples are for the purpose of illustrating the kinds of adjustments, and also the procedure for making them on the work sheet, in the journal, and in the ledger.

Merchandise Inventory Adjustment to Find Cost of Goods Sold

Example 3.

Initial Inventory \$400 + Purchases \$1,200 − Final Inventory \$300 = \$1,300 Cost of Goods Sold.

Diagrammatically this would appear,


INITIAL INVENTORY $400 + PURCHASES $1200 =
TOTAL MERCHANDISE AVAILABLE FOR SALE $ 1600
Final Inventory $ 300
MDSE SOLD $1300
Since these values are at cost Price
$1300 is the cost of Goods Sold
By Formula we may state then
Initial Inventory $ 400 + Purchases $ 1200 − Final Inventory $ 300 = Purchase Cost of Goods Sold $1300

Example 3.

The various steps in the actual adjustment and the manner in which they would appear on the various records are as follows:

First there would be the work sheet (see page 68):

THE WORK SHEET

	Trial Balance		Adjustment Columns		Profit and Loss		Balance Sheet	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Merchandise Inventory	$ 400 00		②$300 00	①$400 00			$300 00	
Purchases	1,200 00		① 400 00	② 300 00	$1,300 00			

(Merely add across algebraically $1,200.00 Dr. + $400.00 Dr. − $300.00 Cr. = $1,300.00 Dr.)

Second, from the adjustment columns of the work sheet the adjustment entries would be made in the journal.

JOURNAL

19—				
Jan.	31	Purchases	$400 00	
		Merchandise Inventory		$400 00
		To transfer the original inventory to the Purchase account		
	31	Merchandise Inventory	$300 00	
		Purchases		$300 00
		To bring the value of the final inventory on the books		

Third, from the journal these entries would be posted to the ledger.

DIAGRAMMATIC LEDGER

Assets = Liabilities + Capital

Permanent — Temporary

Income — Outgo

Merchandise Inventory		Purchases	
$400	$400	$1,200	$ 300
300		400	1,300
		$1,600	$1,600

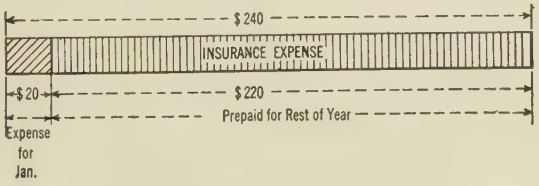
Profit and Loss

Cost of goods sold, $1,300	

Deferred Expense Such as Prepaid Insurance.

Example 4.—Insurance to the amount of $240 is paid in advance for the year 19—. The statements are for the month of January 19—.

Diagrammatically this would appear as,



Example 4*a*.

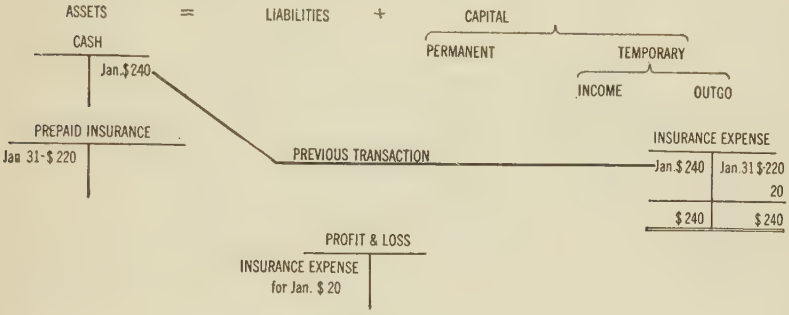
On the work sheet (see page 70),

	Trial Balance		Adjustment Columns		Profit and Loss		Balance Sheet	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Insurance Expense	$240 00		① $220 00		$20 00			
Prepaid Insurance				① $220 00			$220 00	

In the Journal,

19—				
Jan.	31	Prepaid Insurance	$220 00	
		Insurance Expense		$220 00
		To record the value of the prepaid insurance		

In the Diagrammatic ledger,

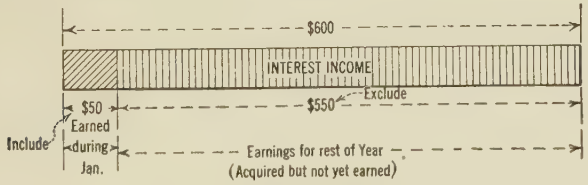


Example 4*b*.

Deferred Income Such as Interest Received but Not Yet Earned.

Example 5.—Interest to the amount of $600 is paid in advance for the year 19—.

Diagrammatically this would appear as,



Example 5*a*.

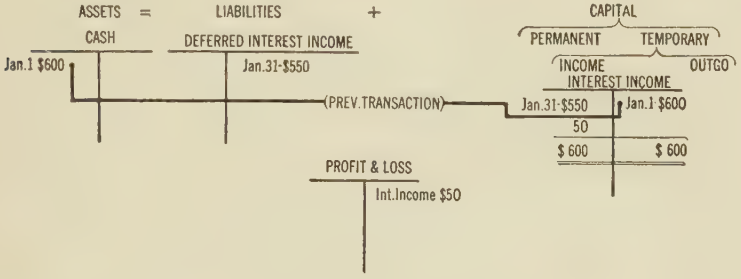
On the work sheet (see page 72),

	Trial Balance		Adjustment Column		Profit and Loss		Balance Sheet	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Interest Income		$600 00	(1) $550 00			$50 00		
Deferred Interest Income				(1) $550 00				$550 00

In the Journal,

19—				
Jan.	31	Interest Income	$550 00	
		Deferred Interest Income		$550 00
		To record the value of the interest received but not yet earned		

In the Ledger,



Example 5*b*.

Accrued Expense Items Such as Accrued Payroll.

Example 6.—At the end of Jan. 31, 19— (Thursday), the firm finds it owes its employees $5,236 which, while actually received so far as service is concerned, is not payable until pay day on Saturday. This amount represents the accrued payroll from Monday to Thursday. The firm, however, must charge it into the operating expenses for January and set up the liability on its books. It will show on the Balance Sheet as an accrued liability (current) very similar to an Account Payable.

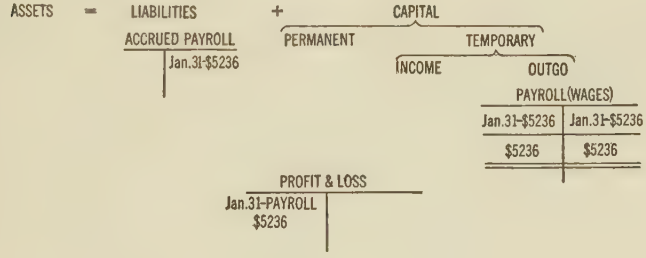
On the work sheet this would appear as (see page 74),

	Trial Balance		Adjustment Column		Profit and Loss		Balance Sheet	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Accrued Payroll				①$5,236 00				$5,236 00
Payroll (wages expense)			①$5,236 00		$5,236 00			

In the Journal,

19—						
Jan.	31	Payroll (wages expense)	$5,236	00		
		Accrued Payroll			$5,236	00
		To record the accrued value of the payroll for month Jan. 19— from Jan. 28–31 inclusive				

In the Ledger,



Example 6.

Accrued Income Such as Accrued Interest.

Example 7.—On Jan. 31, the firm has earned $300 interest on outstanding notes, but as the interest is due in July it is *earned* but not yet *received*, in other words, an accrued income very similar to an account receivable.

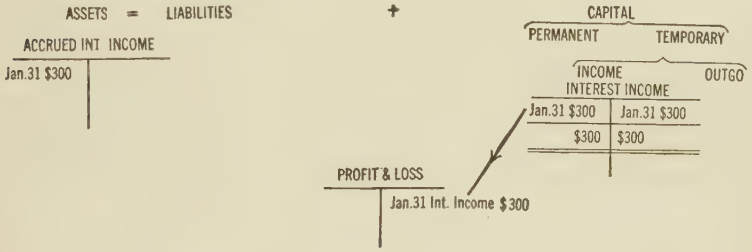
On the work sheet it appears as (see page 76),

	Trial Balance		Adjustment Columns		Profit and Loss		Balance Sheet	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Accrued Interest Income			①$300 00				$300 00	
Interest Income				①$300 00		$300 00		

In the Journal,

19—							
Jan.	31	Accrued Interest Income		$300	00		
		Interest Income				$300	00
		To record the value of the interest on notes earned but not yet received					

In the Ledger,



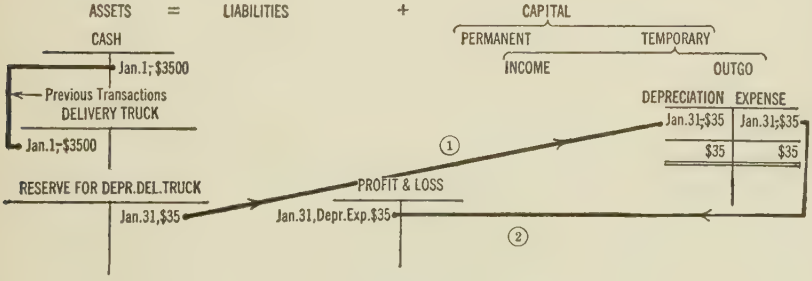
Example 7.

Reserve for Depreciation.

Example 8.—The firm owns a delivery truck valued at $3,500 and wishes to account for depreciation.

The truck is being used daily and parts of it are worn away or consumed in the normal operation of the business in very much the same way as is oil or grease. Depreciation is sometimes referred to as "hole in assets" and, to replace this gradual wearing away, a charge must be made to current operations.

Accounting practice is well agreed that a *Reserve for Depreciation account* shall be opened for each asset being depreciated. Hence, if the depreciation charge on the delivery truck is 1% for the month of January, 19—, the transaction placed in T accounts would appear as follows:



Example 8*a*.

To know the value of the delivery truck, at anytime, read its original value and subtract from it the amount accumulated in the reserve; in other words, read the Delivery Truck account and the Reserve for Depreciation Delivery Truck together. On the Balance sheet this is usually shown as

	Original Value	Reserve for Depreciation	Book Value
Delivery Truck.....	$3,500	$35	$3,465

or

Delivery Truck.....	$3,500	
less Reserve for depreciation.....	35	$3,465

The Reserve for Depreciation account is known as a *Valuation account.* It represents an amount to be charged into current operations toward the ultimate replacement of the original value of the asset.

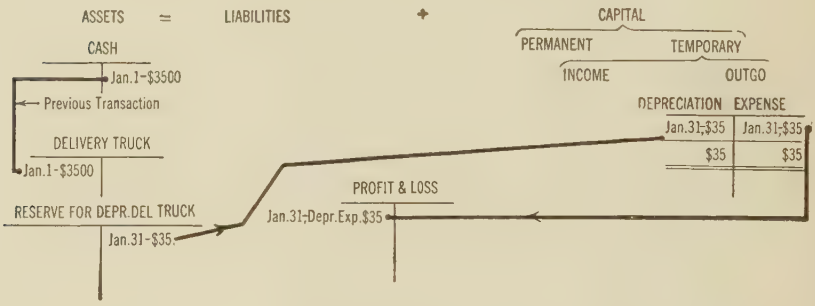
On the work sheet this would appear as (see page 79);

	Trial Balance		Adjustment Columns		Profit and Loss		Balance Sheet	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Delivery Truck	$3,500 00						$3,500 00	
Reserve for Depreciation Del. Truck				(1) $35 00				$35 00
Depreciation Expense			(1) $35 00		$35 00			

In the Journal,

19—						
Jan.	31	Depreciation Expense	$35	00		
		Reserve for Depreciation Delivery Truck			$35	00
		To record the depreciation on delivery truck for Jan.				

In the Ledger,

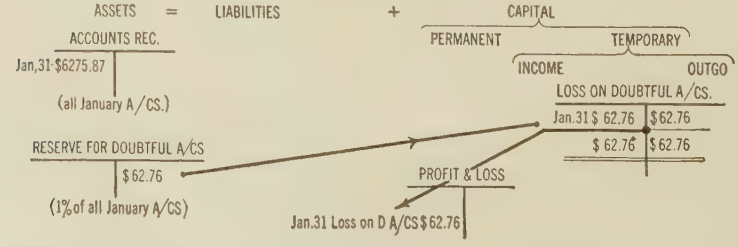


Example 8*b*.

Reserve for Loss on Accounts Receivable : Bad Debts.[1]

Example 9.—From past experience the firm knows that approximately 1% per month of its outstanding accounts will not be collected. Therefore, a reserve is set up at the end of January, 19—, to account for this *anticipated loss*. The reason for this is that the loss should be regarded as an expense of the month in which the sales occur. The particular accounts that will prove bad cannot be determined, but an estimate of probable loss is desirable to get comparable statements. Where this method is not used, other months, say February, March, or April, will be charged with losses on January sales.

On Jan. 31, let the following set-up be assumed



Example 9*a*.

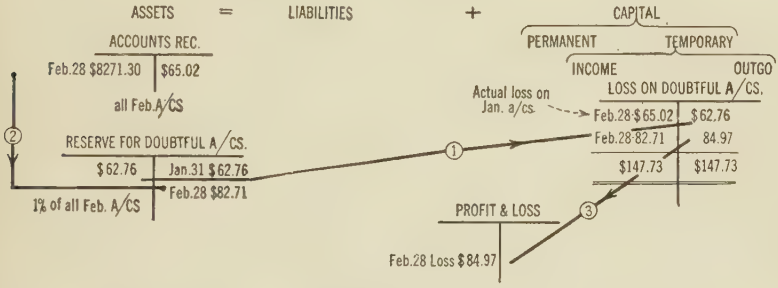
[1] WOODBRIDGE, F. W., "Elements of Accounting," p. 163.

Since the money set aside is always an estimate, an adjustment is usually made at the end of each period.

The actual losses accrued during the period are charged to Loss on Doubtful Accounts and credited to the various accounts which are bad.

At the end of the next month, Feb. 28, let it be assumed an actual loss of $65.02 on January accounts.

1. Close the January reserve into Loss on Doubtful Accounts account.



Example 9*b*.

2. Set up a reserve of 1% of February accounts, receivable.

3. Balance Loss on Doubtful Accounts and close into Profit and Loss.

4. Note, profit and loss then receives the estimated loss for February accounts and the adjustment between the actual and estimated loss on the January accounts. Consequently, by an intelligent estimate, January bore *nearly* its just share of the loss. Without such an estimated reserve, January would not get its share of loss on doubtful accounts. This procedure works throughout the year.

On the Work sheet of Feb. 28 would appear, (see page 82)

	Trial Balance		Adjustment Columns		Profit and Loss		Balance Sheet	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Accounts Receivable	$8,271 30						$8,271 30	
Reserve for Doubtful Accounts		$62 76	(1) $62 76	(2) $82 71				$82 71
Loss on Doubtful Accounts	$65 02		(2) $82 71	(1) $62 76	$84 97			

This procedure is very similar to the Merchandise Inventory adjustments (Merely add across algebraically,

$65.02 Dr. + $82.71 Dr. − $62.76 Cr. = $84.97 Dr.).

In the Journal,

19—						
Feb.	28	Reserve for Loss on Doubtful Accounts	$62	76		
		Loss on Doubtful accounts			$62	76
		To transfer the January reserve into the Loss on Doubtful Accounts account				
	28	Loss on Doubtful accounts	82	71		
		Reserve for Loss on Doubtful accounts			82	71
		To set up February reserve of 1% on outstanding accounts				

The ledger would appear as shown in the original illustration on page 81.

The following more comprehensive work-sheet problem will illustrate many of the foregoing adjustments.

Problem 2.

Given the following trial balance of S. K. Williams, as of Dec. 31, 19—. Using an eight-column work sheet make all necessary adjustments, and take off statements.

S. K. Williams
Trial Balance
Dec. 31, 19—

Cash	$ 2,150	
Accounts Receivable	12,600	
Reserve for Loss on Doubtful Accounts		$ 110
Notes Receivable	1,620	
Inventory Jan. 1, 19—	17,600	
Motor Truck and Equipment	5,500	
Reserve for Depreciation Motor Truck and Equipment		1,100
Furniture and Fixtures	6,000	
Reserve for Depreciation Furniture and Fixtures		1,200
Building	20,000	
Reserve for Depreciation on Building		2,000
Land	7,000	
Accounts Payable		3,350
Notes Payable		1,730
Mortgage on Building		6,500
S. K. Williams, Capital		46,160
S. K. Williams, Personal	185	
Sales		95,260
Sales Returns and Allowances	165	
Purchases	50,725	
Purchase Returns and Allowances		105
Freight in on Purchases	1,250	
Taxes	1,260	
Insurance	470	
Interest Expense	520	
Office Salaries	12,210	
Salesmen's Salaries	16,500	
Stationery and Printing	1,500	
Loss on Doubtful Accounts	260	
	$157,515	$157,515

Additional Information

Merchandise Inventory, Dec. 31	$20,100	
Loss on doubtful accounts is estimated at 2% of Accounts Receivable	252	
Accrued Office Salaries	790	
Unused Stationery	70	
Deferred Taxes	340	
Prepaid Insurance	60	
Accrued Interest	420	

Depreciation Building, 5% original value
Depreciation Motor Truck and Equipment, 10% of original value
Depreciation Furniture and Fixtures, 10% of original value

S. K. Williams
Work Sheet, December 31, 19—

	Trial Balance		Adjustments		Profit & Loss		Balance Sheet	
	Dr.	Cr.	Dr.	Cr.	Outgo	Income	Assets	Lia. & Cap.
Cash	$ 2,150 00						$ 2,150 00	
Accounts Receivable	12,600 00						12,600 00	
Reserve for Loss on Doubt Ac.		$ 110 00	(3)$110 00	(4)$252 00				$252 00
Notes Receivable	1,620 00						1,620 00	
Inventory Jan. 1, 19—	17,600 00		(2)20,100 00	(1)17,600 00			20,100 00	
Motor Truck & Equipment	5,500 00						5,500 00	
Reserve for Depr. Motor Truck & Equipment		1,100 00		(11)550 00				1,650 00
Furniture & Fixtures	6,000 00						6,000 00	
Reserve for Depr. Fixtures		1,200 00		(12)600 00				1,800 00
Building	20,000 00						20,000 00	
Reserve for Depr. on Build.		2,000 00		(10)1,000 00				3,000 00
Land	7,000 00						7,000 00	
Accounts Payable		3,350 00						3,350 00
Notes Payable		1,730 00						1,730 00
Mortgage on Building		6,500 00						6,500 00
S. K. Williams, Capital		46,160 00						46,160 00
S. K. Williams, Personal	185 00						185 00	
Sales		95,260 00				$95,260 00		
Sales Returns & Allowances	165 00				$ 165 00			
Purchases	50,725 00		(1)17,600 00	(2)20,100 00	48,225 00			
Purchase Returns & Allow.		105 00				105 00		
Freight in on Purchases	1,250 00				1,250 00			
Taxes	1,260 00			(7)340 00	920 00			
Insurance	470 00			(8)60 00	410 00			
Interest Expense	520 00		(9)420 00		940 00			
Office Salaries	12,210 00		(5)790 00		13,000 00			
Salesmen's Salaries	16,500 00				16,500 00			
Stationery & Printing	1,500 00			(6)70 00	1,430 00			
Loss on Doubtful Accounts	260 00		(4)252 00	(3)110 00	402 00			790 00
Accrued Office Salaries				(5)790 00			70 00	
Unused Stationery			(6)70 00				340 00	
Deferred Taxes			(7)340 00				60 00	
Prepaid Insurance			(8)60 00					420 00
Accrued Interest				(9)420 00				
Depreciation on Building			(10)1,000 00		1,000 00			
Depreciation on Motor Truck & Equipment			(11)550 00		550 00			
Depreciation on Furniture & Fixtures			(12)600 00		600 00			9,973 00
Balance-profit					9,973 00			
	$157,515 00	$157,515 00	$41,892 00	$41,892 00	$95,365 00	$95,365 00	$75,625 00	$75,625 00

Fig. 11*a*.

S. K. Williams
Balance Sheet
Dec. 31, 19—

Assets				Liabilities and Capital		
Current:				Current Liabilities:		
Cash			$ 2,150	Accounts Payable	$ 3,350	
Accounts Receivable	$12,600			Notes Payable	1,730	
Less Reserve, Bad Debts	252		12,348	Accrued Salaries	790	
Notes Receivable			1,620	Accrued Interest	420	
Merchandise Inventory			20,100	Total Current Liabilities		$ 6,290
Total Current Assets			$36,218			
	Original Value	Reserve for Depreciation	Book Value			
Fixed:				Fixed Liabilities:		
Land			$ 7,000	Mortgage on Building	$ 6,500	
Truck and Equipment	$ 5,500	$ 1,650	3,850			
Furniture and Fixtures	6,000	1,800	4,200	Total Fixed Liabilities		$ 6,500
Building	20,000	3,000	17,000			
Total Fixed Assets			$32,050	Net Worth:		
Deferred:				Capital	$46,160	
Unused Stationery			$ 70	Plus Profit	9,973	
Deferred Taxes			340		56,133	
Prepaid Insurance			60	Less Withdrawal	185	
Total Deferred Assets			$ 470	Net Capital		$55,948
				Total Liabilities and Net Worth		$68,738
Total Assets			$68,738			

S. K. Williams
Statement of Profit and Loss
From Jan. 1, 19—, to Dec. 31, 19—

Gross Sales			$95,260	00		
Less Sales Returns and Allowances			165	00		
Net Sales					$95,095	00
Deduct:						
Inventory Jan. 1, 19—			17,600	00		
Purchases	$50,725.00					
Less Returns and Allowances	105.00		50,620	00		
Freight In on Purchases			1,250	00		
			69,470	00		
Less Inventory Dec. 31, 19—			20,100	00		
Cost of Goods Sold					49,370	00
Gross Profit on Sales					$45,725	00
Deduct Operating Expenses						
Taxes			920	00		
Insurance			410	00		
Interest Expense			940	00		
Office Salaries			13,000	00		
Salesmen's Salaries			16,500	00		
Stationery and Printing			1,430	00		
Loss on Doubtful Accounts			402	00		
Depreciation on Building			1,000	00		
Depreciation on Motor Truck and Equipment			550	00		
Depreciation on Furniture and Fixtures			600	00	35,752	00
Net Profit					$ 9,973	00

SUMMARY

In Chap. VI the following accounting points were emphasized:

1. The operation and construction of the work sheet. It was pointed out that this sheet is an important instrument of accounting procedure, and while it forms no actual part of the books themselves, it is a very important auxiliary working statement.

2. By means of the work sheet all adjustments are made at the end of the period and the *real accounts* are separated from the *nominal accounts*, in this way giving the items, carefully listed, that go to make up the Balance Sheet and the Profit and Loss Statement.

3. Adjustment entries must always be made at the end of the accounting period and their purpose is to include in the accounting period only the expense items, income items, etc. that pertain to that particular period and to exclude all others.

4. In a trading business the seven types of adjustment entries met with are:

Merchandise Inventory Adjustment.
Deferred Expense Items.
Deferred Income Items.
Accrued Expense Items.
Accrued Income Items.
Reserve for Depreciation.
Reserve for Loss on Accounts Receivable.

CHAPTER VII

PROCEDURE AT END OF FISCAL PERIOD— CLOSING THE BOOKS

OBJECT OF CHAPTER: (*a*) to outline a recommended closing procedure, (*b*) to illustrate "spreading" the work-sheet entries on the books.

Order of Procedure.

Although no arbitrary rule may be laid down as to the method of procedure at the end of the fiscal period, it undoubtedly will be of assistance to have a schedule to follow.

A recommended procedure, using the work sheet and assuming the last routine entry to have been posted to the ledger, is as follows:

1. Take a preclosing trial balance to check the mechanical accuracy of the routine work.
2. Prepare a work sheet making adjustment entries for accruals, deferrals, and inventories.
3. Make closing entries on work sheet.
4. Take off statements.
5. Make adjusting and closing entries from work sheet to the journal.
6. Post adjusting and closing entries to ledger.
7. Take postclosing trial balance of the ledger.

Diagrammatically this would appear as shown in Fig. 12.

Before proceeding further, however, it may be well to review and to study certain of the questions of fundamental importance. In so doing, the material of the previous chapters may be used as well as quotations from texts of recognized authorities.

Review Question 1.

What is the difference between the preclosing and postclosing trial balance?

Answer.

The *preclosing trial balance* is taken before closing the books. It is taken by either of the two methods studied previously, and contains *both real and nominal accounts.*

The postclosing trial balance differs from the preclosing trial balance in that it contains only *real accounts.*

In closing the ledger, errors may be made in recording the transfers from one account to another which will throw the ledger out of balance, *i.e.*, the proprietorship equation will not be in equilibrium. To test the accuracy of the closing entries, and to afford a means of comparing the assets, liabilties, and capital in the Balance Sheet with the same items in the ledger, it is

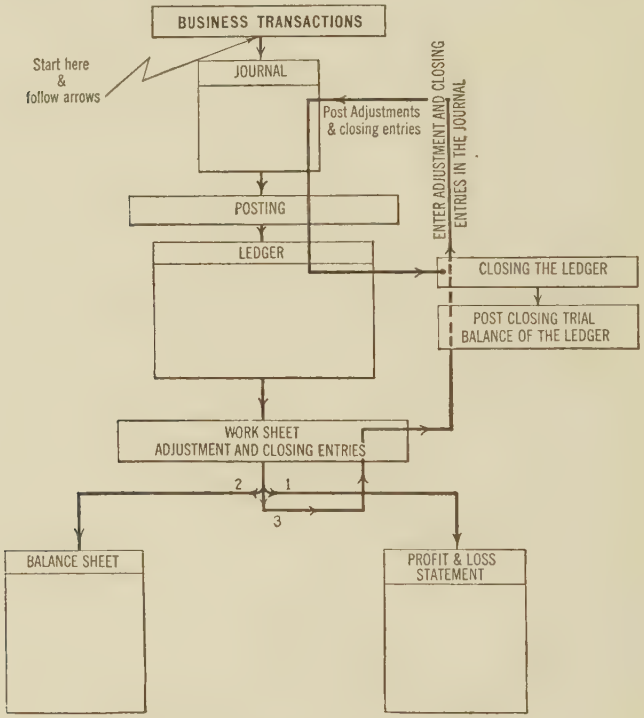


FIG. 12.—Procedure for closing the books.

customary to prepare another trial balance *after closing the ledger* called a "postclosing trial balance." This trial balance will contain the same items as the Balance Sheet.

Review Question 2.

What shall be the length of the accounting period, and how is it determined?

Answer.

(*a*) The *accounting period*, in general, is the unit of time selected for the purpose of determining and presenting the facts of income and financial condition. Its length varies in different enterprises and industries, and depends upon how frequently financial statements are desirable and feasible.

In probably a majority of business enterprises the significant fiscal and accounting period is the year (calendar or otherwise). Semi-annual, quarterly, and even monthly periods are common, however, especially in the case of larger and more complex concerns.

"The necessity for the period has already been suggested in several connections. As has been pointed out, a complete accounting from day to day for the fundamental facts, which it is the business of the accountant to discover and report, would be well-nigh impossible; *it is only periodically that it is expedient to attempt to reduce the data of the events, processes and conditions which affect the financial status of a business to their lowest terms.*

"Explicit transactions such as purchases, sales, collections, payments, and so on are commonly registered as they occur; but *cost of sales*—the expired value of materials, labor, equipment, etc.—is usually calculated and recorded in full *only at regular intervals.* The need for periodic adjustment accordingly arises. The routine work of the bookkepeer must be supplemented regularly by a further process of accounting, a process which introduces valuations and accruals and makes it possible to draw conclusions with respect to income for the period and current financial conditions."[1]

(*b*) "The time intervening between the beginning and ending dates is the *accounting cycle*, the *accounting period*, or the *fiscal period* and it may be any length. The usual practice is to close the books once each year. However, many businesses close more frequently—some every 6 months; some every 4 months; others every 3 months; and still others every calendar month, with a summary for the 12 months comprising the year. If the books are closed Dec. 31 for the year, the accounting or fiscal period is the same as the calendar year. The 4-week period has been adopted by many concerns. This has the advantage of making every one of the 13 periods in the year (52 weeks) of equal length. The usual summary of the 13 periods would give the desired information for the fiscal or for the calendar year."[2]

Review Question 3.

Why should the books be closed?

Answer.

"The *reason* for closing the books is to clear all accounts of changes that affect capital, and to prepare them to record increases and decreases during the next period. This is done by first recording all items of this period not yet recorded and by correcting all errors which the trial balance or other means have brought to light. Then the accounts which have recorded the day-to-day increases and decreases in capital (Temporary Proprietorship Accounts) must be transferred to the Profit and Loss Account or Summary. From the Profit and Loss Account the net increase (or decrease) in capital is transferred to the Proprietors' Drawing Account, the balance of which is then transferred to his Capital Account. The ledger will then show the same financial condition as the Balance Sheet."[3]

[1] PATON, "Accounting," p. 201.
[2] KOOPMAN and KESTER, "Fundamentals of Accounting," pp. 211–212.
[3] KOOPMAN and KESTER, "Fundamentals of Accounting," Vol. 1, p. 168.

Review Question 4.

When should the books be closed?

Answer.

In practice, books are closed, in most cases, at the end of the fiscal year of the business rather than at the end of each month. The nominal accounts in the working trial balance prepared at the end of each month, will thus be cumulative, and the same nominal accounts at the end of the next previous month subtracted from the nominal accounts on the latest trial balance, will show the results of operation for the most recent month. The principal objection to monthly closing lies in the difficulty of preparing a *Profit and Loss Statement for the entire year.* Monthly statements may be prepared, no matter whether the books are closed or not, or whether even the adjusting entries have been spread on the books.[1]

Review Question 5.

What is the Profit and Loss Account, and what part does it play in closing the books?

Answer.

"The *Profit and Loss* Account is a temporary proprietorship account used solely for the purpose of *summarizing* the proprietorship changes before the more permanent record is made in the capital title. The balance, *i.e.*, the difference between the two sides, is always transferred to *Capital.*"[2] It acts as a "clearing house," and but for the universal use of the name "Profit and Loss Account" it would more readily come under the title "Summary of Income and Outgo Account."

Transferring Figures to the Books: Adjusting Entries.

When a work sheet is used, the entire process is worked out and proved on the work sheet prior to making of the *journal entries.*

After this, the adjusting entries may be made directly from these adjustment columns of the work sheet. The journalizing of these adjustments will be much simplified, if care is taken to letter each adjustment as instructed.

The complete process of journalizing, posting, drawing up a trial balance and work sheet, making statements, and closing the books may well be illustrated by the Problem of R. V. Gleason and its solution which follows.

Use of Red Ink.

In the following problem, and in all other parts of this text, the use of red-ink entries and rulings have been omitted.

[1] Kohler and Morrison, "Principles of Accounting," pp. 192–193.

[2] Koopman and Kester, Vol. 1, p. 123.

Many accountants contend that all balances and rulings should be in red ink, and their reason is a very good one in that in rereading the books, red-ink rulings and balances make the task much easier.

Efficiency experts and many of the engineering accountants contend that the changing from one pen to another is a waste of time, and, therefore, all entries should be made in black ink.

Since the rereading feature is not of greatest importance in this presentation, the latter view will be adopted for use in this text.

Problem. 1

Complete Problem of Journalizing, Posting, Using Trial Balance and Work Sheet, Making Statements and Closing the Books.

1. Make opening journal entries.
2. Journalize all transactions.
3. Open ledger accounts and post.
4. Take preclosing trial balance.
5. Prepare a complete work sheet.
6. Prepare statements.
7. Make adjusting and closing entries from work sheet to journal.
8. Post these to ledger, and balance the accounts.
9. Take postclosing trial balance.

Sept. 1, 1928.

R. V. Gleason began business, on Sept. 1, as sole owner of a machine-tool business. On this date, he has a balance of $5,250 in the bank; bonds and stocks worth $5,000; real estate worth $25,000; building, $20,000; equipment, $25,000. The real estate is mortgaged for $15,000 bearing date of July 1, 1928, with interest at 6% payable semiannually, principal due July 1, 1930. All taxes are paid up to Sept. 1.

3. Purchased $5,000 material from the U. S. Steel Company; paid $3,000 in cash, balance on account.
4. Paid insurance premium for 1 year on building and equipment, $900, cash.
6. Signed contract with the Universal Advertising Company giving them $400 in advance.
8. Paid salaries, $1,250.
   Sold Brown and Sharp tools for cash, $3,500.
10. Sold Call Hardware Company tools for cash, $350.
    Sold DeLong and Bros., tools on account, $700.
12. Purchased $15,000 material from Bethlehem Steel Company, Paid $3,000 in cash; gave $5,000 non-interest-bearing note, due Sept. 26; $7,000 on account.
13. Purchased miscellaneous supplies for machines, $75.

14. Sold Stanley Company, tools, $9,000; received $5,000 in cash; carried balance on account.
15. Paid wages, $1,900.
    Freight expense, $125.
17. Withdrew $500 in cash for personal use.
19. Purchased a Gridley Automatic for $3,500; paid $1,000 in cash and $2,500 on account from the National Acme Company.
20. Purchased $6,200 material from U. S. Steel; gave 2-month note for $5,000; balance in cash.
21. Sold Jones and Lamson tools for cash, $3,000; 4% discount allowed.
    Returned material to U. S. Steel, $300.
22. Paid wages, $1,750.
    Office supplies, $72.
24. Purchased $2,500 material from Wickwire, Spencer Steel Company, for cash; 5% discount allowed.
    Received check, Stanley Co., $2,000.
25. Sold Walters Garage, $25 tools, cash.
    Sold LaPointe Company, $6,500 tools; $3,000 in cash at 3% discount; balance on account.
26. Paid note to Bethlehem Steel Company from the sale of his bonds and stocks.
    Sold Wyckoff Company $12,720 tools; $5,000 cash at 4% discount; balance on account.
27. LaPointe Company returned defective tools, $150.
29. Paid Wages, $2,250.
    Received invoice from Universal Advertising Company for $200, advertising.

Additional Information

1. Merchandise inventory, Oct. 1..... $5,300.
2. Insurance Prepaid, 11 months.
3. Office supplies on hand..... 15.
4. Accrued taxes for month..... 45.
5. Depreciation expense on building.....0.4% original value.
6. Depreciation equipment..... 1.2%.
7. Accrued Interest, mortgage.

Ithaca, N. Y. J—1

1928							
Sept.	1	Cash	L-1	$ 5,250	00		
		Bonds and Stocks	L-2	5,000	00		
		Real Estate	L-4	25,000	00		
		Building	L-4	20,000	00		
		Equipment	L-5	25,000	00		
		Mortgage on Real Estate	L-8			$15,000	00
		Principal due 7/1/30, interest @ 6%					
		Accrued Interest	L-8			150	00
		2 months' interest on mortgage					
		R. V. Gleason, Capital	L-9			65,100	00
		To record the assets liabilities		$80,250	00	$80,250	00
		and capital of R. V. Gleason					

OPENING JOURNAL ENTRY.

NOTE: The journal, ledger, work sheet and statements are complete in themselves. To follow the closing procedure however the reader must study the procedure for closing the books as outlined on page 89 and in Fig. 12. This procedure is indicated by the circled numbers ①, ② etc., in the following pages.

J—2 Ithaca, N. Y.

1928								
Sept.	3	Purchases	L-11	$5,000	00			
		Cash	L- 1			$3,000	00	
		U. S. Steel Company,	L- 6			2,000	00	
		For material purchased from U. S. Steel Company						
	4	Insurance	L-12	900	00			
		Cash	L- 1			900	00	
		Insurance premium for 1 year on Building and Equipment						
	6	Advertising Contract	L- 6	400	00			
		Cash	L- 1			400	00	
		For advertising contract with Universal Advertising Company						
	8	Salaries	L-13	1,250	00			
		Cash	L- 1			1,250	00	
	8	Cash	L- 1	3,500	00			
		Sales	L-10			3,500	00	
		To Brown and Sharpe						
	10	Cash	L- 1	350	00			
		Sales	L-10			350	00	
		Sale of tools to Call Hardware Company						
	10	Delong and Brothers	L- 2	700	00			
		Sales	L-10			700	00	
		Sale of tools on account to Delong and Brothers						

Ithaca, N. Y. J—3

1928								
Sept.	12	Purchases	L-11	$15,000	00			
		Cash	L- 1			$3,000	00	
		Notes Payable	L- 7			5,000	00	
		Bethlehem Steel Company	L- 7			7,000	00	
		For material purchased from Bethlehem Steel Company Note due Sept. 26, no interest						
	13	Machine Expense	L-14	75	00			
		Cash	L- 1			75	00	
		For purchase of miscellaneous supplies for machines						
	14	Cash	L- 1	5,000	00			
		Stanley Company	L- 2	4,000	00			
		Sales	L-10			9,000	00	
		Sale of tools to Stanley Company						
	15	Salaries	L-13	1,900	00			
		Cash	L- 1			1,900	00	
	15	Freight Expense	L-13	125	00			
		Cash	L- 1			125	00	
	17	Personal Account	L- 9	500	00			
		Cash	L- 1			500	00	

J—4 Ithaca, N. Y.

1928							
Sept.	19	Equipment	L- 5	$3,500	00		
		Cash	L- 1			$1,000	00
		National Acme Company	L- 7			2,500	00
		For purchase of a Gridley Automatic from National Acme Company					
	20	Purchases	L-11	6,200	00		
		Cash	L- 1			1,200	00
		Notes Payable	L- 7			5,000	00
		For purchase of material from U. S. Steel—2-month note					
	21	Cash	L- 1	2,880	00		
		Sales Discount	L-11	120	00		
		Sales	L-10			3,000	00
		To record a sale of tools to Jones and Lamson at 4% discount					
	21	U. S. Steel Company	L- 6	300	00		
		Purchase Returns	L-12			300	00
		To record material returned to U. S. Steel Company					
	22	Salaries	L-13	1,750	00		
		Cash	L- 1			1,750	00

Ithaca, N. Y. J—5

1928								
Sept.	22	Office Expense	L-13	$	72	00		
		Cash	L- 1				$ 72	00
	24	Purchases	L-11	2,500		00		
		Purchase Discount	L-12				125	00
		Cash	L- 1				2,375	00
		To record purchase of material from Wickwire, Spencer Steel Company, at 5% discount						
	24	Cash	L- 1	2,000		00		
		Stanley Company	L- 2				2,000	00
		Received check on payment of account						
	25	Cash	L- 1		25	00		
		Sales	L-10				25	00
		Tools sold to Walters Garage						
	25	Cash	L- 1	2,910		00		
		Sales Discount	L-11		90	00		
		La Pointe Company	L- 3	3,500		00		
		Sales	L-10				6,500	00
		To record sale of tools to La Pointe Company, at 3% cash discount						

J—6 Ithaca, N. Y.

1928								
Sept.	26	Notes Payable	L- 7	$ 5,000	00		
		Bonds and Stocks	L- 2			$ 5,000	00
		To record payment of note to Bethlehem Steel Company, with Bonds and Stocks					
	26	Cash	L- 1	4,800	00		
		Sales Discount	L-11	200	00		
		Wycoff Company	L- 3	7,720	00		
		Sales	L-10			12,720	00
		To record sale of tools to Wycoff Company at 4% cash discount					
	27	Sales Returns	L-10	150	00		
		LaPointe Company	L- 3			150	00
		To record return of defective tools					
	29	Salaries	L-13	2,250	00		
		Cash	L- 1			2,250	00
	29	Advertising Expense	L-14	200	00		
		Advertising Contract	L- 6			200	00
		To record invoice received from Universal Advertising Company					

① The next step is to post these entries to the ledger (see pages 103 to 110 inclusive and Fig. 12).

Ithaca, N. Y. J—7

1928		Adjustment Entries					
Oct.	1	Merchandise Inventory	L- 3	$ 5,300	00		
		Purchases	L-11			$ 5,300	00
		To bring the asset value of the new inventory on books					
	1	Prepaid Insurance	L- 5	825	00		
		Insurance Expense	L-12			825	00
		To bring on books the asset value of unused portion of the insurance expense					
	1	Unused Office Supplies	L- 6	15	00		
		Office Expense	L-13			15	00
		To bring on books the asset value of unused portion of the office supplies					
	1	Tax Expense	L-14	45	00		
		Accrued Taxes	L- 8			45	00
		To bring on books the tax expense for the month					
	1	Depreciation Expense on Building	L-15	80	00		
		Depreciation Expense on Equipment	L-15	342	00		
		Reserve for Depreciation of Building	L- 4			80	00
		Reserve for Depreciation of Equipment	L- 5			342	00
		To charge depreciation of current period to operating accounts					
	1	Interest Expense	L-15	75	00		
		Accrued Interest	L- 8			75	00
		To bring on books the interest expense for the month					

J—8 Ithaca, N. Y.

1928		Closing Entries					
Oct.	1						
		Sales	L-10	$35,795	00		
		Purchase Returns	L-12	300	00		
		Purchase Discount	L-12	125	00		
		Profit and Loss	L-16			$36,220	00
		To close the income accounts to Profit and Loss					
	1	Profit and Loss	L-16	32,184	00		
		Sales Returns	L-10			150	00
		Sales Discount	L-11			410	00
		Purchases (cost of goods sold)	L-11			23,400	00
		Insurance Expense	L-12			75	00
		Salaries	L-13			7,150	00
		Freight Expense	L-13			125	00
		Office Expense	L-13			57	00
		Advertising Expense	L-14			200	00
		Machine Expense	L-14			75	00
		Tax Expense	L-14			45	00
		Depreciation, Building	L-15			80	00
		Depreciation, Equipment	L-15			342	00
		Interest Expense	L-15			75	00
		To close outgo accounts to Profit and Loss					

J—9 Ithaca, N. Y.

1928		Transfer Entries					
Oct.							
	1	Profit and Loss	L-16	$ 4,036	00		
		R. V. Gleason, Personal	L- 9			$ 4,036	00
		To transfer the net profit to proprietor's Personal Account					
	1	R. V. Gleason, Personal	L- 9	3,536	00		
		R. V. Gleason, Capital	L- 9			3,536	00
		To credit Gleason's Capital Account with the net increase in the value of the business					

④ When the adjusting and closing entries are completed in the Journal they are posted to the ledger (see pages 104 to 110 and Fig. 12).

Ithaca, N. Y.
Cash L—1

1928						1928					
Sept.	1	Original Investment	J-1	$ 5,250	00	Sept.	3	Purchases	J-2	$ 3,000	00
"	8	Sales	J-2	3,500	00	"	4	Insurance	J-2	900	00
"	10	Sales	J-2	350	00	"	6	Adv. Contract	J-2	400	00
"	14	Sales	J-3	5,000	00	"	8	Salaries	J-2	1,250	00
"	21	Sales	J-4	2,880	00	"	12	Purchases	J-3	3,000	00
"	24	Stanley Company	J-5	2,000	00	"	13	Machine Expense	J-3	75	00
"	25	Sales	J-5	25	00	"	15	Salaries	J-3	1,900	00
"	25	Sales	J-5	2,910	00	"	15	Freight Expense	J-3	125	00
"	26	Sales	J-6	4,800	00	"	17	Personal	J-3	500	00
						"	19	Equipment	J-4	1,000	00
						"	20	Purchases	J-4	1,200	00
						"	22	Salaries	J-4	1,750	00
						"	22	Office Expense	J-5	72	00
						"	24	Purchases	J-5	2,375	00
						"	29	Salaries	J-6	2,250	00
								Balance		6,918	00
				$26,715	00					$26,715	00
		Balance Forward		$6,918	00						

Ithaca, N. Y.
Bonds and Stocks L—2

1928						1928					
Sept.	1	Original Investment	J-1	$ 5,000	00	Sept.	26	Notes Payable	J-6	$ 5,000	00
				$ 5,000	00					$ 5,000	00

Delong and Bros.

1928						1928					
Sept.	10	Sales	J-2	$ 700	00	Oct.	1	Balance		$ 700	00
				$ 700	00					$ 700	00
Oct.	1	Balance Forward		$ 700	00						

Stanley Company

1928						1928					
Sept.	14	Sales	J-3	$ 4,000	00	Sept.	24	Cash	J-5	$ 2,000	00
						Oct.	1	Balance		2,000	00
				$ 4,000	00					$ 4,000	00
Oct.	1	Balance Forward		$ 2,000	00						

Ithaca, N. Y.
La Pointe Company — L—3

1928						1928					
Sept.	25	Sales	J-5	$ 3,500	00	Sept.	27	Sales Returns	J-6	$ 150	00
						Oct.	1	Balance		3,350	00
				$ 3,500	00					$ 3,500	00
Oct.	1	Balance Forward		$ 3,350	00						

Wycoff Company

1928						1928				
Sept.	26	Sales	J-6	$ 7,720	00	Oct.	1	Balance		$ 7,720	00
				$ 7,720	00					$ 7,720	00
Oct.	1	Balance Forward		$ 7,720	00						

Merchandise Inventory

1928						1928				
Oct.	1	Purchases	J-7	$ 5,300	00	Oct.	1	Balance		$ 5,300	00
				$ 5,300	00					$ 5,300	00
Oct.	1	Balance Forward		$ 5,300	00						

Ithaca, N. Y.
Real Estate — L—4

1928						1928				
Sept.	1	Original Investment	J-1	$25,000	00	Oct.	1	Balance		$25,000	00
				$25,000	00					$25,000	00
Oct.	1	Balance Forward		$25,000	00						

Buildings

1928						1928				
Sept.	1	Original Investment	J-1	$20,000	00	Oct.	1	Balance		$20,000	00
				$20,000	00					$20,000	00
Oct.	1	Balance Forward		$20,000	00						

Reserve for Depreciation of Building

1928						1928					
Oct.	1	Balance		$ 80	00	Oct.	1	Depreciation Expense	J-7	$ 80	00
				$ 80	00					$ 80	00
						Oct.	1	Balance Forward		$ 80	00

Ithaca, N. Y.

Equipment L—5

1928					1928				
Sept.	1	Original Investment	J-1	$25,000 00	Oct.	1	Balance		$28,500 00
	19	Cash, Nat'l Acme Company	J-4	3,500 00					
				$28,500 00					$28,500 00
Oct.	1	Balance Forward		$28,500 00					

Reserve for Depreciation of Equipment

1928					1928				
Oct.	1	Balance		$ 342 00	Oct.	1	Depreciation Expense	J-7	$ 342 00
				$ 342 00					$ 342 00
					Oct.	1	Balance Forward		$ 342 00

Prepaid Insurance

1928					1928				
Oct.	1	Insurance Expense	J-7	$ 825 00	Oct.	1	Balance		$ 825 00
				$ 825 00					$ 825 00
Oct.	1	Balance Forward		$ 825 00					

Ithaca, N. Y.

Advertising Contract L—6

1928					1928				
Sept.	6	Cash	J-2	$ 400 00	Sept.	29	Advertising Expense	J-6	$ 200 00
					Oct.	1	Balance		200 00
				$ 400 00					$ 400 00
Oct.	1	Balance Forward		$ 200 00					

Unused Office Supplies

1928					1928				
Oct.	1	Office Expenses	J-7	$ 15 00	Oct.	1	Balance		$ 15 00
				$ 15 00					$ 15 00
Oct.	1	Balance Forward		$ 15 00					

U. S. Steel Company

1928					1928				
Sept.	21	Purchase Returns	J-4	$ 300 00	Sept.	3	Purchases	J-2	$ 2,000 00
Oct.	1	Balance		1,700 00					
				$ 2,000 00					$ 2,000 00
					Oct.	1	Balance Forward		$ 1,700 00

Ithaca, N. Y.

Bethlehem Steel Company — L—7

1928					1928				
Oct.	1	Balance		$ 7,000 00	Sept.	12	Purchases	J-3	$ 7,000 00
				$ 7,000 00					$ 7,000 00
					Oct.	1	Balance Forward		$ 7,000 00

National Acme Company

1928					1928				
Oct.	1	Balance		$ 2,500 00	Sept.	19	Equipment	J-4	$ 2,500 00
				$ 2,500 00					$ 2,500 00
					Oct.	1	Balance Forward		$ 2,500 00

Notes Payable

1928					1928				
Sept.	26	Bonds and Stocks	J-6	$ 5,000 00	Sept.	12	Purchases	J-3	$ 5,000 00
Oct	1	Balance		5,000 00		20	Purchases	J-4	5,000 00
				$10,000 00					$10,000 00
					Oct.	1	Balance Forward		$ 5,000 00

Ithaca, N. Y.

Accrued Interest — L—8

1928					1928				
Oct.	1	Balance		$ 225 00	Sept.	1	2 Months Mortgage interest	J-1	$ 150 00
					Oct.	1	1 month Mortgage Interest	J-7	75 00
				$ 225 00					$ 225 00
					Oct.	1	Balance Forward		$ 225 00

Accrued Taxes

1928					1928				
Oct.	1	Balance		$ 45 00	Oct.	1	Tax Expense	J-7	$ 45 00
				$ 45 00					$ 45 00
					Oct.	1	Balance Forward		$ 45 00

Mortgages

1928					1928				
Oct.	1	Balance		$15,000 00	Sept.	1	Mortgage 7/1/28	J-1	$15,000 00
				$15,000 00					$15,000 00
					Oct.	1	Balance Forward		$15,000 00

Ithaca, N. Y.

R. V. Gleason, Capital L—9

1928					1928				
Oct.	1	Balance		$68,636 00	Sept.	1	Original Investment	J-1	$65,100 00
					Oct.	1	R. V. Gleason, Personal	J-9	3,536 00
				$68,636 00					$68,636 00
					Oct.	1	Balance Forward		$68,636 00

R. V. Gleason, Personal

1928					1928				
Sept.	17	Cash	J-3	$ 500 00	Oct.	1	Profit and Loss	J-9	$ 4,036 00
Oct.	1	R. V. Gleason, Capital	J-9	3,536 00					
				$ 4,036 00					$ 4,036 00

Ithaca, N. Y.

Sales L—10

1928					1928				
Oct.	1	Profit and Loss	J-8	$35,795 00	Sept.	8	Cash	J-2	$ 3,500 00
						10	Cash	J-2	350 00
						10	Delong and Bros.	J-2	700 00
						14	Cash	J-3	9,000 00
						21	Cash, 4% Discount	J-4	3,000 00
						25	Cash	J-5	25 00
						25	Cash, 3% Discount	J-5	6,500 00
						26	Cash, 4% Discount	J-6	12,720 00
				$35,795 00					$35,795 00

Sales Returns

1928					1928				
Sept.	27	La Pointe Company	J-6	$ 150 00	Oct.	1	Profit and Loss	J-8	$ 150 00
				$ 150 00					$ 150 00

Ithaca, N. Y.

Sales Discount L—11

1928					1928				
Sept.	21	Sales	J-4	$ 120 00	Oct.	1	Profit and Loss	J-8	$ 410 00
	25	Sales	J-5	90 00					
	26	Sales	J-6	200 00					
				$ 410 00					$ 410 00

Purchases

1928					1928				
Sept.	3	Cash, U. S. Steel	J-2	$ 5,000 00	Oct.	1	Merchandise, Inventory	J-7	$ 5,300 00
	12	Cash, Notes, & Accounts Payable	J-3	15,000 00		1	Profit and Loss	J-8	23,400 00
	20	Cash, Notes Payable	J-4	6,200 00					
	24	Cash, 5 % Discount	J-5	2,500 00					
				$28,700 00					$28,700 00

Ithaca, N. Y.

Purchase Returns L—12

1928					1928				
Oct.	1	Profit and Loss	J-8	$ 300 00	Sept.	21	U. S. Steel	J-4	$ 300 00
				$ 300 00					$ 300 00

Purchase Discount

1928					1928				
Oct.	1	Profit and Loss	J-8	$ 125 00	Sept.	24	Purchase	J-5	$ 125 00
				$ 125 00					$ 125 00

Insurance Expense

1928					1928				
Sept.	4	Cash	J-2	$ 900 00	Oct.	1	Prepaid Insurance	J-7	$ 825 00
						1	Profit and Loss	J-8	75 00
				$ 900 00					$ 900 00

Ithaca, N. Y.

Salaries L—13

1928					1928				
Sept.	8	Cash	J-2	$ 1,250 00	Oct.	1	Profit and Loss	J-8	$ 7,150 00
	15	Cash	J-3	1,900 00					
	22	Cash	J-4	1,750 00					
	29	Cash	J-6	2,250 00					
				$ 7,150 00					$ 7,150 00

Freight Expense

1928					1928				
Sept.	15	Cash	J-3	$ 125 00	Oct.	1	Profit and Loss	J-8	$ 125 00
				$ 125 00					$ 125 00

Office Expense

1928					1928				
Sept.	22	Cash	J-5	$ 72 00	Oct.	1	Unused Supplies	J-7	$ 15 00
						1	Profit and Loss	J-8	57 00
				$ 72 00					$ 72 00

Ithaca, N. Y.

Advertising Expense L—14

1928					1928				
Sept.	29	Advertising Contract	J-6	$ 200 00	Oct.	1	Profit and Loss	L-8	$ 200 00
				$ 200 00					$ 200 00

Machine Expense

1928					1928				
Sept.	13	Cash	J-3	$ 75 00	Oct.	1	Profit and Loss	J-8	$ 75 00
				$ 75 00					$ 75 00

Tax Expense

1928					1928				
Oct.	1	Accrued Taxes	J-7	$ 45 00	Oct.	1	Profit and Loss	J-8	$ 45 00
				$ 45 00					$ 45 00

Ithaca, N. Y.

Depreciation Expense—Building L—15

1928						1928					
Oct.	1	Reserve for Depreciation	J-7	$	80 00	Oct.	1	Profit and Loss	J-8	$	80 00
				$	80 00					$	80 00

Depreciation Expense—Equipment

1928						1928					
Oct.	1	Reserve for Depreciation	J-7	$	342 00	Oct.	1	Profit and Loss	J-8	$	342 00
				$	342 00					$	342 00

Interest Expense

1928						1928					
Oct.	1	Accrued Interest	J-7	$	75 00	Oct.	1	Profit and Loss	J-8	$	75 00
				$	75 00					$	75 00

② When routine postings have been completed the next step is to draw up the work sheet and take off the statements (see pages 111, 112 and 113).

Ithaca, N. Y.

Profit and Loss L—16

1928						1928					
Oct.	1	Sales Returns	J-8	$	150 00	Oct.	1	Sales	J-8	$35,795 00	
		Sales Discount	J-8		410 00		1	Purchase Returns	J-8		300 00
		Purchases (Cost of Goods Sold)	J-8		23,400 00		1	Purchase Discount	J-8		125 00
		Insurance Expense	J-8		75 00						
		Salaries	J-8		7,150 00						
		Freight Expense	J-8		125 00						
		Office Expense	J-8		57 00						
		Advertising Expense	J-8		200 00						
		Machine Expense	J-8		75 00						
		Tax Expense	J-8		45 00						
		Depreciation Building	J-8		80 00						
		Depreciation Equipment	J-8		342 00						
		Interest Expense	J-8		75 00						
		Net Profit	J-9		4,036 00						
				$36,220 00						$36,220 00	

⑤ When the ledger is completely posted and closed, the post closing trial balance (see page 114 and Fig. 12) is taken as a final check on the accuracy of the work.

R. V. Gleason
Work Sheet—Oct. 1, 1928

Accounts	Preclosing Trial Balance		Adjustments		Profit Loss		Balance Sheet	
	Dr.	Cr.	Dr.	Cr.	Outgo	Income	Assets	Liab. & Cap.
Cash	$ 6,918 00						$6,918 00	
Delong and Bros.	700 00						700 00	
Stanley Company	2,000 00						2,000 00	
LaPointe Company	3,350 00						3,350 00	
Wycoff Company	7,720 00						7,720 00	
Merchandise Inventory			(1) $5,300 00				5,300 00	
Real Estate.	25,000 00						25,000 00	
Buildings	20,000 00						20,000 00	
Reserve for Depreciation				(5) $80 00				$ 80 00
Equipment	28,500 00						28,500 00	
Reserve for Depreciation				(6) 342 00				342 00
Prepaid Insurance			(2) 825 00				825 00	
Advertising Contract	200 00						200 00	
Unused Office Supplies			(3) 15 00				15 00	
U. S. Steel Company		$ 1,700 00						1,700 00
Bethlehem Steel Company		7,000 00						7,000 00
National Acme Company		2,500 00						2,500 00
Notes Payable		5,000 00						5,000 00
Accrued Interest		150 00		(7) 75 00				225 00
Accrued Taxes				(4) 45 00				45 00
Mortgage		15,000 00						15,000 00
R. V. Gleason, Capital		65,100 00						65,100 00
R. V. Gleason, Personal	500 00						500 00	
Sales		35,795 00				$35,795 00		
Sales Returns	150 00				$ 150 00			
Sales Discount	410 00				410 00			
Purchases	28,700 00			(1) 5,300 00	23,400 00			
Purchase Returns		300 00				300 00		
Purchase Discount		125 00				125 00		
Insurance Expense	900 00			(2) 825 00	75 00			
Salaries	7,150 00				7,150 00			
Freight Expense	125 00				125 00			
Office Expense	72 00			(3) 15 00	57 00			
Advertising Expense	200 00				200 00			
Machine Expense	75 00				75 00			
Tax Expense			(4) 45 00		45 00			
Depreciation Expense on Bldg.			(5) 80 00		80 00			
Depreciation Expense on Equip.			(6) 342 00		342 00			
Interest Expense			(7) 75 00		75 00			
Balance					4,036 00			4,036 00
	$132,670 00	$132,670 00	$6,682 00	$6,682 00	$36,220 00	$36,220 00	$101,028 00	$101,028 00

R. V. Gleason
Balance Sheet, Oct. 1, 1928

Assets				Liabilities and Net Worth		
Current Assets				Current Liabilities		
Cash			$ 6,918	Accounts Payable	$11,200	
Accounts Receivable			13,770	Notes Payable	5,000	
Merchandise Inventory			5,300	Interest Accrued	225	
Total Current Assets			$25,988 $ 25,988	Taxes Accrued	45	
				Total Current Liabilities	$16,470	$ 16,470
Fixed Assets:						
Real Estate:			$25,000	Fixed Liabilities		
	Original Value	Depreciation		Mortgage	$15,000	
Building	$20,000	$ 80	19,920			
Equipment	28,500	342	28,158			
Total Fixed Assets			$73,078 $ 73,078		$15,000	$ 15,000
Deferred Assets:				Net Worth		
Prepaid Insurance			$ 825	R. V. Gleason, Capital	$65,100	
Advertising Contract			200	Profit	$4,036	
Unused Office Supplies			15	Withdrawals	500	
					3,536	
Total Deferred Assets			$ 1,040 $ 1,040	Total Net Worth	$68,636	$ 68,636
Total Assets			$100,106	Total Liabilities and Net Worth		$100,106

R. V. Gleason
Profit and Loss Statement
From Sept. 1, 1928 to Oct. 1, 1928

Gross Sales			$35,795 00
Less Sales Returned		$ 150 00	
Sales Discount		410 00	
			560 00
Net Sales			$35,235 00
Deduct Cost of Sales			
Purchases		$28,700 00	
Less Purchases Returned	$ 300.00		
Purchases Discount	125.00		
Inventory Oct. 1, 1928	5,300.00		
		5,725 00	
			22,975 00
Gross Profit			$12,260 00
Deduct Expenses			
Insurance		$ 75 00	
Salaries		7,150 00	
Freight		125 00	
Office		57 00	
Advertising		200 00	
Machine		75 00	
Taxes		45 00	
Depreciation on Building		80 00	
Depreciation on Equipment		342 00	
Interest		75 00	
			8,224 00
Net Profit			$ 4,036 00

③ When the work sheet is completed and the statements taken off, the next step is to journalize the adjusting and closing entries. This is done by entering the items shown on the Work Sheet under "Adjustments" and "Profit and Loss," in the journal (see pp. 101 and 102 and Fig. 12).

Postclosing Trial Balance

	Debit	Credit
Cash	$ 6,918 00	
Delong and Bros	700 00	
Stanley Company	2,000 00	
LaPointe Company	3,350 00	
Wycoff Company	7,720 00	
Merchandise Inventory	5,300 00	
Real Estate	25,000 00	
Buildings	20,000 00	
Reserve for Depreciation, Building		$ 80 00
Equipment	28,500 00	
Reserve for Depreciation, Equipment		342 00
Prepaid Insurance	825 00	
Advertising Contract	200 00	
Unused Office Supplies	15 00	
U. S. Steel Company		1,700 00
Bethlehem Steel Company		7,000 00
National Acme Company		2,500 00
Notes, Payable		5,000 00
Accrued Interest		225 00
Accrued Taxes		45 00
Mortgage		15,000 00
R. V. Gleason, Capital		68,636 00
	$100,528 00	$100,528 00

SUMMARY

In Chap. VII the following accounting points were emphasized.

1. While no arbitrary rule is applicable to the closing procedure, the use of a definite schedule such as laid down on page 89 and shown diagrammatically in Fig. 12 is highly desirable.

2. The preclosing trial balance contains both *real and nominal accounts.*

3. The postclosing trial balance differs from the preclosing trial balance in that it contains only *real accounts.*

4. The accounting period is a unit of time selected for the purpose of determining and presenting the facts of income and financial condition.

5. The books should be closed for the purpose of clearing all accounts of changes that affect capital, and to prepare them to record increases and decreases during the next period.

6. The Profit and Loss account is an account in the General Ledger (care must be taken not to confuse this account with the Profit and Loss statement which is a document entirely outside of the books themselves) which may be termed a Temporary Proprietorship Account and is used for the purpose of summarizing the proprietorship changes.

7. The routine of solving a complete problem ties in all of the accounting points studied in previous chapters.

CHAPTER VIII

METHODS TO INSURE DIVISION OF LABOR[1]

OBJECT OF CHAPTER: (*a*) to show the application of the principles of division of labor and specialization to the journal; (*b*) to show the development of the Sales Journal; (*c*) to show the development of the Purchase Journal; (*d*) to show the development of the Cash Book.

The Need of Specialization.

By glancing at the organization chart of even an average concern, it can readily be appreciated that the methods developed previously are not entirely adequate for modern business. It will be noted that a sales manager is in charge of sales, a purchasing agent in charge of purchases, and a cashier in charge of cash. This specialization in business and industry is the direct result of the need of experts in each particular field. These experts, in turn, must be provided with specialized information concerning their particular field. This information must be of such a nature as to give real aid in executive control. The sales manager is interested in knowing the total volume of the sales at any time, the purchasing agent is interested in keeping the total purchases below a certain figure, and the cashier must have an ever-ready and up-to-date knowledge of the cash on hand. Obviously, the journal, as it has been used in the past, will not furnish this information.

The journal may be broken up, however, into various special journals as for example the Sales Journal, which would handle all work pertaining to sales, a Purchase Journal for all purchases, and a Cash Book (journal) for all cash transactions, retaining a General Journal to "catch" all items not covered by the special books.

The double-entry principle lends itself to such a scheme through the means of the compound-journal entry. A few sales transactions may be considered under both methods.

Jan. 5, Sold to Jack Smith, Merchandise;	$700
Jan. 6, Sold to Howard LeNoir, Merchandise;	45
Jan. 7, Sold to John Knapp, Merchandise;	60

[1] WOODBRIDGE, F. W., "Elements of Accounting," Chap. VII.

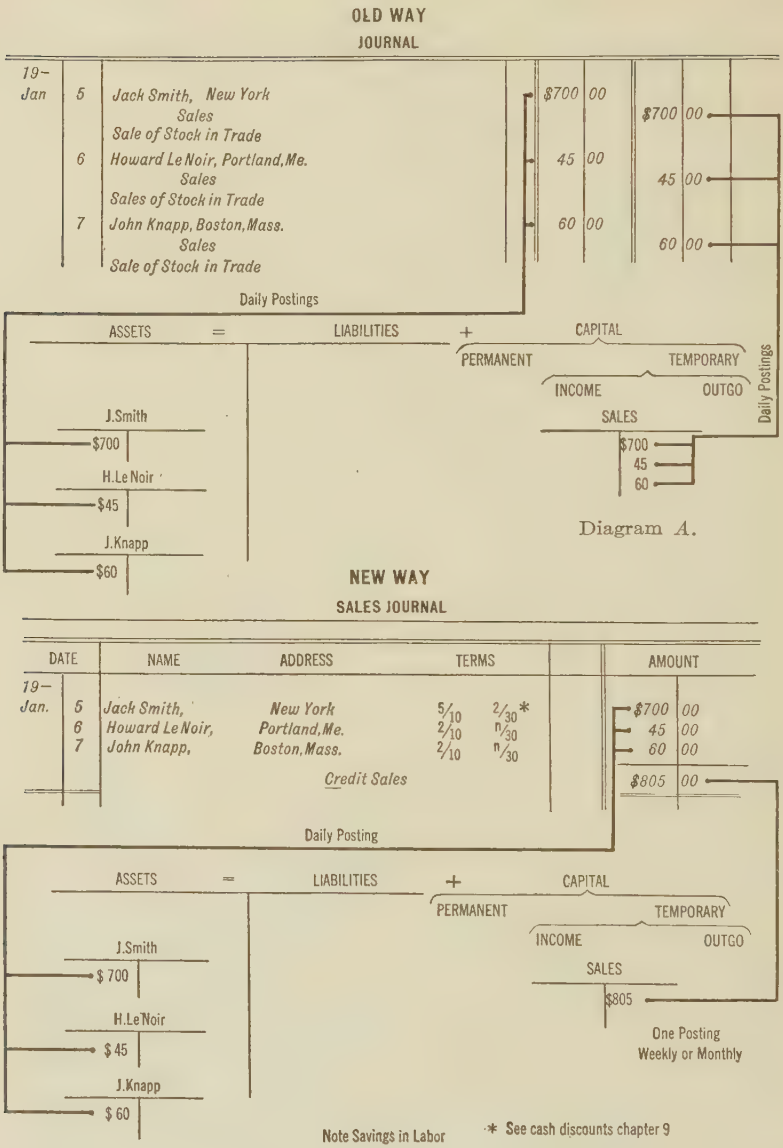


Diagram B.

FIG. 13.

Referring to Fig. 13, Diagram A, the solution as made by the old journal method is given. Three separate double entries are required. An equal number of ledger postings are also made.

By applying the principle of the compound-journal entry, these items may be written as follows:

Jack Smith	$700	
Howard LeNoir	45	
John Knapp	60	
Sales		$805

The Sales Journal.

It becomes evident that since all these items originate from sales, they may all be entered in a Sales Journal, posting the individual debits to customer's accounts daily, and making one lump credit posting to Sales, weekly or monthly. By doing this, a labor-saving device is originated which cuts the amount of work approximately in two. Diagram B fully illustrates this procedure.

In order then to save labor, but particularly to aid in executive control, the Sales Journal may be used, entering in it all items pertaining to the sale of merchandise to customers. In order that the standing of each customer may be known at any time, the debits are posted daily to the various customers' accounts. At the end of the week or the month the book is totaled and one posting is made as a credit to the Sales Account.

To illustrate the workings of the Sales Journal, the following representative problem is solved:

Jan.	4. Sold to S. Warren, 231 N. 17th Street, City, Merchandise, n/30	$ 8.80
	8. Sold to G. R. Blake, 560 Central Avenue, City, Merchandise, 1/10	22.00
	15. Sold to T. S. Berna, 24 Clinton Street, City, Merchandise, n/30	9.60
	26. Sold to R. B. King, 130 Water Street, City, Merchandise, 2/10	15.75
	28. Sold to A. Howe, 600 S. 10th Street, City, Merchandise, n/30	4.25
	29. Sold to M. R. Sheldon, 415 N. 17th Street, City, Merchandise, n/30	11.45
Feb.	1. Sold to A. B. Potter, 133 Bank Street, City, Merchandise, n/30	5.40
	7. Sold to S. C. Kirby, 2341 N. 12th Street, City, Merchandise, 1/10	13.70

9. Sold to J. LeConey, 172 Main Street, City, Merchandise, n/30 ..... 7.50
13. Sold to E. Thomson, 322 S. 9th Street, City, Merchandise, 2/10 ..... 21.00
17. Sold to M. R. Sherrill, 900 N. 19th Street, City, Merchandise, 2/10 ..... 35.75
22. Sold to H. K. Smith, 105 Chester Avenue, City, Merchandise, n/30 ..... 9.60
28. Sold to C. M. Lewis, 750 Greenwood Road, City, Merchandise, 1/10 ..... 17.35

Solution

SALES JOURNAL

19—			Folio				
Jan.	4	S. Warren, 231 N. 17th Street, City, n/30	10	$ 8	80		
	8	G. R. Blake, 560 Central Avenue, City, 1/10	10	22	00		
	15	T. S. Berna, 24 Clinton Street, City, n/30	11	9	60		
	26	R. B. King, 130 Water Street, City, 2/10	11	15	75		
	28	A. Howe, 600 S. 10th Street, City, n/30	12	4	25		
	29	M. R. Sheldon, 415 N. 17th Street, City, n/30	12	11	45		
		Sales Credit	25	$ 71	85		
Feb.	1	A. B. Potter, 133 Bank Street, City, n/30	13	$ 5	40		
	7	S. C. Kirby, 2341 N. 12th Street, City, 1/10	13	13	70		
	9	J. LeConey, 172 Main Street, City, n/30	14	7	50		
	13	E. Thomson, 322 S. 9th Street, City, 2/10	14	21	00		
	17	M. R. Sherrill, 900 N. 19th Street, City, 2/10	15	35	75		
	22	H. K. Smith, 105 Chester Avenue, City, n/30	15	9	60		
	28	C. M. Lewis, 750 Greenwood Road, City, 1/10	16	17	35		
		Sales Credit	25	$110	30		

Ledger

Assets = Liabilities + Capital

⑩ S. Warren	⑬ A. B. Potter
$8.80	$5.40
⑩ G. R. Blake	⑬ S. C. Kirby
$22.00	$13.70
⑪ T. S. Berna	⑭ J. LeConey
$9.60	$7.50
⑪ R. B. King	⑭ E. Thomson
$15.75	$21.00
⑫ A. Howe	⑮ M. R. Sherrill
$4.25	$35.75
⑫ M. R. Sheldon	⑮ H. K. Smith
$11.45	$9.60
⑯ C. M. Lewis	
$17.35	

Permanent	Temporary
Income	
㉕ Sales	
	$ 71.85
	110.30

Problem in Development of Purchase Book.

The Purchase Journal.

In exactly the same manner the question of purchasing may be handled (see Fig. 14). While the volume of purchases may not be as large as that of sales, nevertheless, an up-to-date journal record of purchases is imperative to every live executive. The Purchase Book in which is recorded all purchases of merchandise bought for the purpose of sale is the result, and its workings may be easily followed by reference to page 120. A still larger and more vital mechanism developed from the purchase records in the form of the voucher system will be described in full in Chap. X.

Jan. 5. Purchased from Brown and Company, Merchandise on account, $450

6. Purchased from White Brothers, Merchandise on account, $600

7. Purchased from Harold Black, Merchandise on account, $75

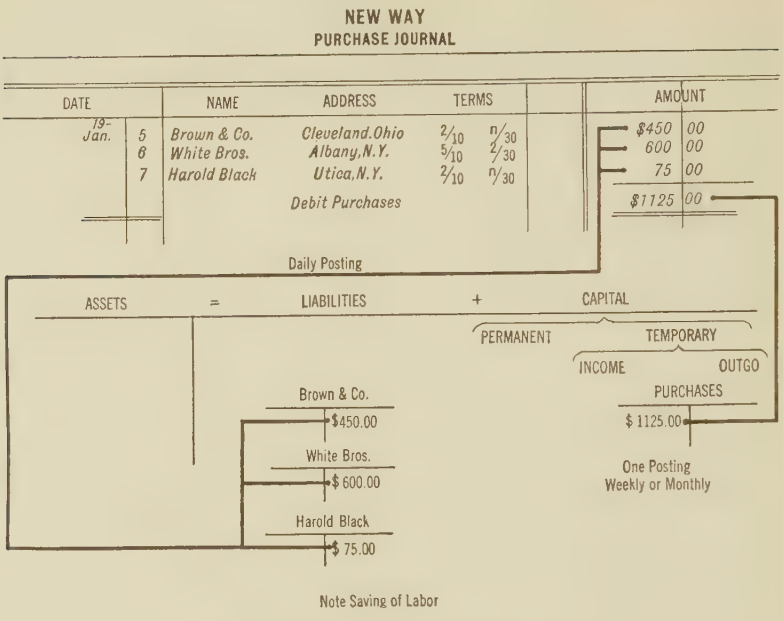


Fig. 14.

To illustrate the operation of the purchase journal the following representative problem is solved:

Jan. 1. Purchased from Root and Company, 214 Elm Street, City, Merchandise, 1/10 n/30 ..... $100
2. Purchased from H. M. Rogers, 1143 Main Street, City, Merchandise, 2/10 n/30 500
9. Purchased from C. Moore and Company, 403 Main Street, City, Merchandise, 5/10 n/60 750
24. Purchased from F. S. Murray, 128 Jefferson Street, City, Merchandise, 5/10 n/60 800
30. Purchased from H. M. Rogers, 1143 Main Street, City Merchandise, n/30 250
Feb. 1. Purchased from J. P. Jones Company, 793 Bourland Avenue, City, Merchandise, 5/10 n/60 ..... $880
5. Purchased from C. L. Houser, 111 S. Logan Street, City, Merchandise, 2/10 n/30 300
8. Purchased from Root and Company, 214 Elm Street, City, Merchandise, n/30 150
10. Purchased from W. Smith, 912 Race Street, City, Merhcandise, n/30 220
16. Purchased from C. Moore and Company, 403 Main Street, City, Merchandise, 5/10 n/60 700

20. Purchased from H. E. Barron, 787 Fairmount Street, City, Merchandise, 2/10 n/30..... 500
23. Purchased from R. B. Simpson, 832 Green Street, City, Merchandise, n/10..... 100
27. Purchased from W. Smith, 912 Race Street, City, Merchandise, n/30. 450

PURCHASE BOOK

19—			Folio					
Jan.	1	Root and Company, 214 Elm Street, City, 1/10 n/30	20	$	100	00		
	2	H. M. Rogers, 1143 Main Street, City, 2/10 n/30	20		500	00		
	9	C. Moore and Company, 403 Main Street, City, 5/10 n/60	21		750	00		
	24	F. S. Murray, 128 Jefferson Street, City, 5/10 n/60	21		800	00		
	30	H. M. Rogers, 1143 Main Street, City, n/30	20		250	00		
		Purchases, Debit	31	$2,400		00		
Feb.	1	J. P. Jones Company, 793 Bourland Avenue, City, 5/10 n/60	22	$	880	00		
	5	C. L. Houser, 111 S. Logan Street, City, 2/10 n/30	22		300	00		
	8	Root and Company, 214 Elm Street, City, n/30	20		150	00		
	10	W. Smith, 912 Race Street, City, n/30	23		220	00		
	16	C. Moore and Company, 403 Main Street, City, 5/10 n/60	21		700	00		
	20	H. E. Barron, 787 Fairmount Street, City, 2/10 n/30	23		500	00		
	23	R. B. Simpson, 832 Green Street, City, n/10	24		100	00		
	27	W. Smith, 912 Race Street, City, n/30	23		450	00		
		Purchases, Debit	31	$3,300		00		

LEDGER

Assets = Liabilities + Capital

Root & Co. ⑳		C. L. Houser ㉒	
	$100.00		$300.00
	150.00		

H. M. Rogers ⑳		W. Smith ㉘	
	$500.00		$220.00
	250.00		450.00

C. Moore & Co. ㉑		H. E. Barron ㉘	
	$750.00		$500.00
	700.00		

F. S. Murray ㉑		R. B. Simpson ㉔	
	$800.00		$100.00

J. P. Jones Co. ㉒	
	$880.00

Permanent Temporary

Outgo

㉛ Purchases	
$2,400.00	
3,300.00	

The Cash Book (Journal).

Cash, even more vital than sales or purchases, lends itself in a similar manner to specialization. If we imagine the T, which represents the ledger account, expanded into two pages as shown in the following diagram, a clear idea of the cash book may be obtained. All transactions having to do with the receipt of

CASH

Cash Debit					Cash Credit				
Date	Acc. to be Cr.	Exp.	Amount	Total	Date	Acc. to be Dr.	Exp.	Amount	Total

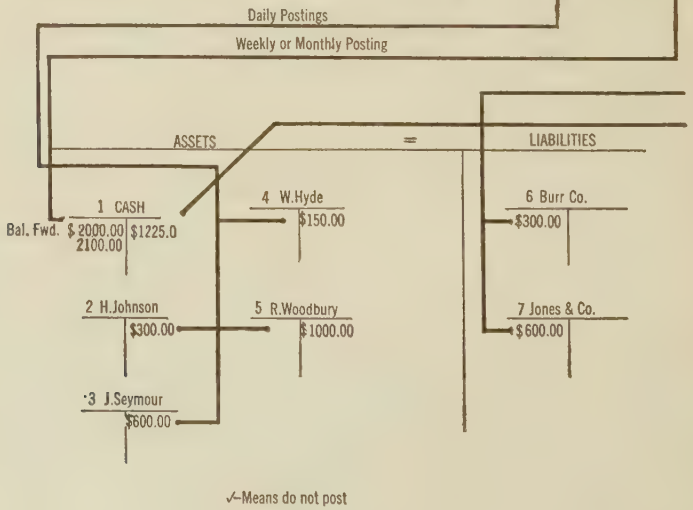
cash are entered on the left side, and all items pertaining to the expenditure of cash are entered on the right side. Each day the individual credits from the income side are posted to their respec-

tive ledger account. The same procedure is carried out for the expenditure side. Weekly or monthly the Cash Book is totaled and a lump debit posting is made from the income side of the cash book to the Ledger Cash Account. Similarly, the total of the expenditure side is carried to the credit side of that account. In this way, a great amount of labor is saved and the cash record is kept up-to-date.

The complete working of the Cash Book may best be illustrated by the following problem and its solution: (see top of page 125 for statement of problem).

DEBIT SIDE

DATE		ACCOUNT TO BE CR.	EXPLANATION	FOLIO	AMOUNT	TOTAL
19–						
May	1	Balance Fwd.		✓		$2000.00
		Harold Johnson	on account	2	$300.00	
	2	John Seymour	on account	3	600.00	
		Interest Income	from bonds	8	50.00	
	4	Walter Hyde	on account	4	150.00	
		Ralph Woodbury	on account	5	1000.00	
		Cash Dr.		1		$2100.00
						$4100.00
May	6	Balance Fwd.		✓		$2875.00

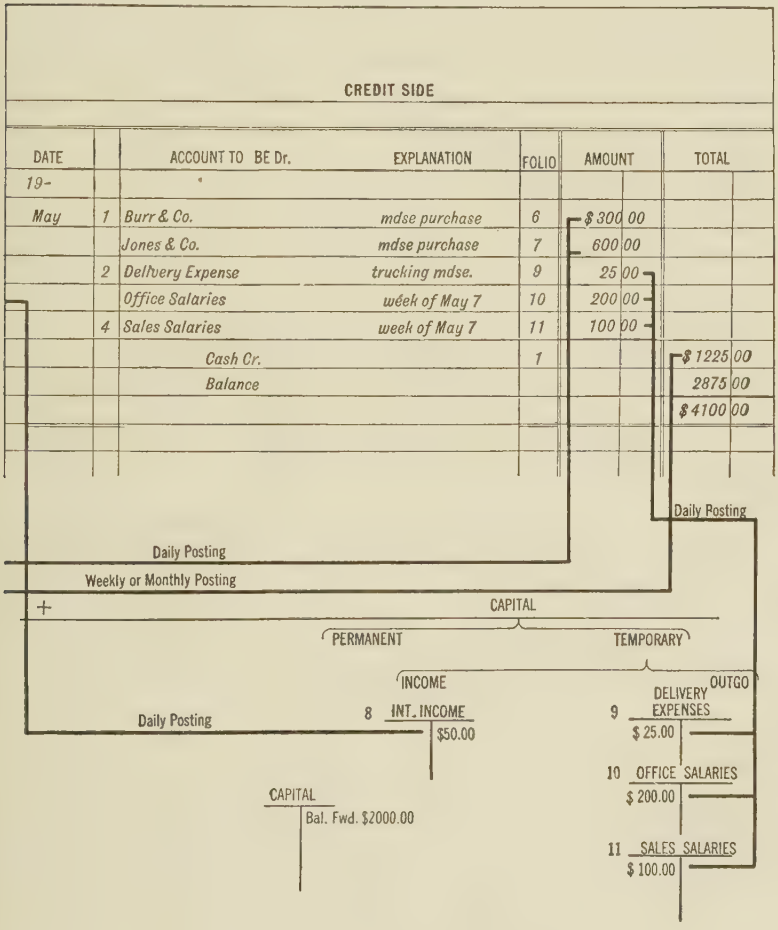


✓–Means do not post

Solution

Problem on Cash Book

May	1.	Balance Forwarded..... $2,000
	1.	Burr Company, paid on account..... 300
	1.	Jones and Company, paid on account..... 600
	1.	Harold Johnson received on account..... 300
	2.	Paid Delivery expense..... 25
	2.	Office Salaries..... 200
	2.	John Seymour, received on account..... 600
	2.	Received Interest on Bonds..... 50
	4.	Walter Hyde, received on account..... 150
	4.	Paid Sales Salaries, week of May 7..... 100
	4.	Ralph Woodbury received on account..... 1,000



to Problem.

As the business grows larger, even greater specialization is sometimes attained. This results in the case of the cash transaction in two separate books, one to handle all receipts of cash and the other to handle all disbursements of cash. These are called as their function implies, the "Cash Receipts Journal" and the "Cash Disbursement Journal."

The General Journal.

To complete the line of books of original entry there must be added a General Journal, or one in which the miscellaneous or sundry items, not covered by the special books, are entered.

The question naturally arises as to what books are to be specialized. The answer depends entirely upon the business and its particular types of transactions. Many transactions may ordinarily be expected in the line of sales, purchases, and cash. If the firm is in the custom of accepting a large number of notes, a Notes Receivable Journal may be added as a labor-saving device.

There is no fixed rule for time of posting from the General Journal to the ledger. The best practice, however, is to post at the close of each day.

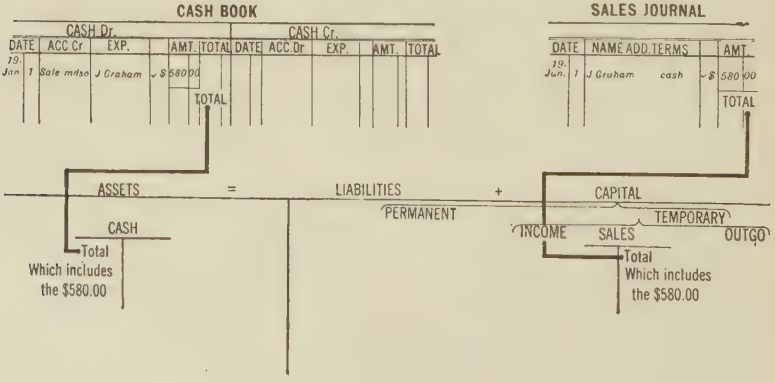
Problems in Posting when Special Books Are Used.

Posting under the special books involves a few considerations that should be fully mastered. The following series of examples will bring out the points to be emphasized.

Example 1. A Sale for Cash.

Sold to James Graham $580 merchandise for cash.

a. This transaction involves the two special books, the Sales Journal and the Cash Book and is therefore entered directly in both and checked (✓).



Solution to Example 1.

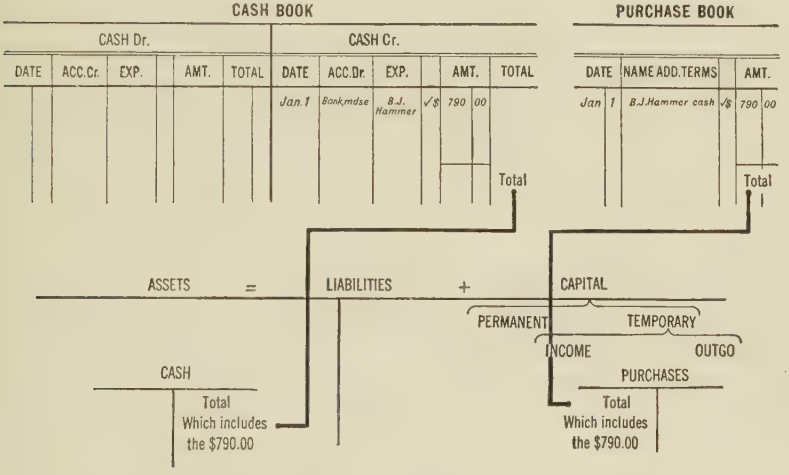
The Check (√) Means Do Not Post Individually.

At the end of the month when the books are totaled both values find their way to the debit and credit of the Cash and Sales Account through the total of these books.

Example 2. A Purchase for Cash.

Purchased from B. J. Hammer, $790 worth of merchandise for cash.

a. The transaction is very similar to that of Example 1, and is handled in much the same way.

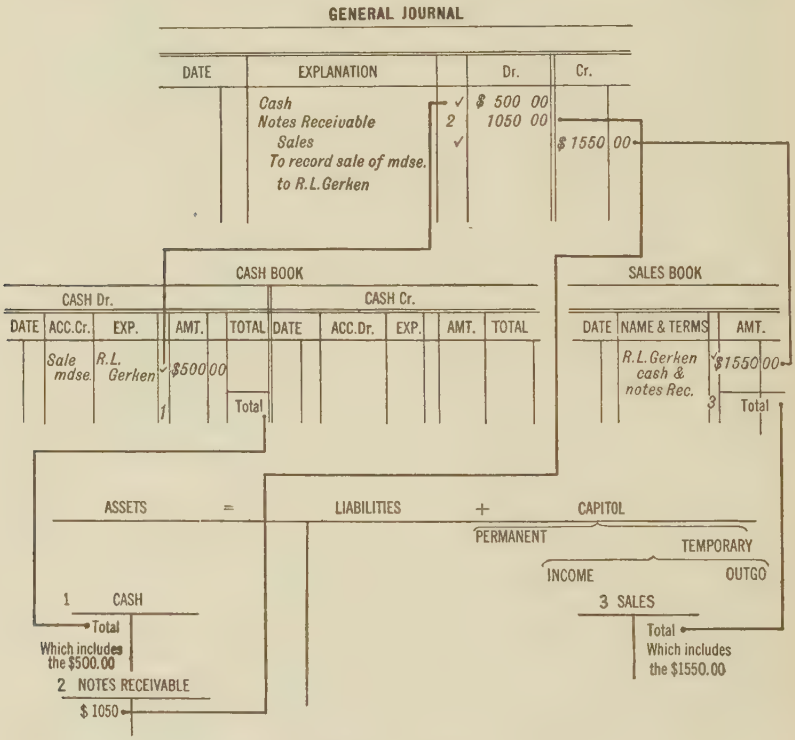


Solution to Example 2.

Example 3. A Mixed Transaction: One Involving Items, Some of Which Are Covered by the Special Journal and Others Which are Not.

a. While accounting practice is not fully agreed as to the handling of an entry of this type, this rule may be laid down for this work. Wherever a mixed transaction appears, first, enter it completely in the General journal; second, enter the items covered by the special books in the special books, *i.e.*, Sales, Cash, etc.; third, make all postings from the General Journal, checking the special books to prevent double postings.

Sold to R. L. Gerken, $1,550 merchandise, receiving $500 cash and taking his note for the remainder.



Solution to Example 3.

Problem 1. Use of the Cash Book.

1. Oct. 1. L. S. Wilson invested $3,150, cash, in business.
3. Paid office rent for the month of October, $75.
4. Received from George Hill, to apply on account, $85.
5. Paid clerk's salary, $20.
6. Paid A. R. Brown, $56.75 to apply on account.
8. Received from Brandon and Brandon, $105 to apply on account.
10. Received $68 from S. R. Nixon to apply on account.
11. Purchased office supplies, for cash, amounting to $42.
12. Received $63.15, interest.
13. Paid clerk's salary, $20.
14. Paid J. R. Dodds $118 in full payment of account.
18. L. S. Wilson withdrew $100 for personal use.
20. Received $97.50 from A. L. Marsh, to apply on account.
24. Paid $16.50 for freight.
26. Received from James Robinson, on account, $209.
28. Paid for advertising, $30.
31. Paid salesman's expenses, $80.

Nov. 1. Paid office rent for the month of November, $75.
2. Paid for telephone service, $4.50.
3. Paid clerk's salary, $20.
5. Received $75 from S. R. Nixon to apply on account.
8. Received $215.75 from A. L. Marsh to apply on account.
9. Paid clerk's salary, $20.
11. Received $125 from Bower and Black for unsatisfactory goods returned to them.
14. Paid $12 express charges.
16. Received from George Hill, $35 to apply on account.
18. L. S. Wilson withdrew $150 for personal use.
21. Paid clerk's salary, $20.
22. Paid J. R. Dodds $50 to apply on account.
24. Received of James Robinson, $115 to apply on account.
26. Received $150 from Ross Miller in full payment of account.
28. Received $78.50 from Brandon and Brandon to apply on account.
30. Paid clerk's salary, $20.
Paid salesman's salary, $175.

Journal Page 1

		Accounts to be credited	Explanation						
19—									
Oct.	1	L. S. Wilson	Capital, 10/1/27		$3,150	00			
	4	George Hill	Cash on Account		85	00			
	8	Brandon and Brandon	Cash on Account		105	00			
	10	S. R. Nixon	Cash on Account		68	00			
	12	Interest			63	15			
	20	A. L. Marsh	Cash on Account		97	50			
	26	James Robinson	Cash on Account		209	00			
		Cash, Dr.		1			$3,777	65	
							$3,777	65	
Nov.	1	Balance Forward		✓			$3,219	40	
	5	S. R. Nixon	Cash on Account		$ 75	00			
	8	A. L. Marsh	Cash on Account		215	75			
	11	Bower and Black	Cash for Goods Returned		125	00			
	16	George Hill	Cash on Account		35	00			
	24	James Robinson	Cash on Account		115	00			
	26	Ross Miller	Cash in full of Account		150	00			
	28	Brandon and Brandon	Cash on Account		78	50			
		Cash, Dr.		1			$ 794	25	
							$4,013	65	
Dec.	1	Balance Forward		✓			$3,467	15	

Debit Side of Cash Book.

Solution to

Journal Page 2

19—		Accounts to be debited	Explanation					
Oct.	3	Office Rent	Month of October		$ 75	00		
	5	Clerk's Salary			20	00		
	6	A. R. Brown	Cash on Account		56	75		
	11	Office Supplies			42	00		
	13	Clerk's Salary			20	00		
	14	J. R. Dodds	Full payment of Account		118	00		
	18	L. S. Wilson	Personal		100	00		
	24	Freight			16	50		
	28	Advertising			30	00		
	31	Salesman's Expense			80	00		
		Cash, Cr.		1			$ 558	25
		Balance					3,219	40
							$3,777	65
Nov.	1	Office Rent	Month of November		$ 75	00		
	2	Telephone Service			4	50		
	3	Clerk's Salary			20	00		
	9	Clerk's Salary			20	00		
	14	Express Charges			12	00		
	18	L. S. Wilson	Personal		150	00		
	21	Clerk's Salary			20	00		
	22	J. R. Dodds	Cash on Account		50	00		
	30	Clerk's Salary			20	00		
	30	Salesman's Salary			175	00		
		Cash, Cr.		1			$546	50
		Balance					3,467	15
							$4,013	65

Credit Side of Cash Book.

Problem 1.

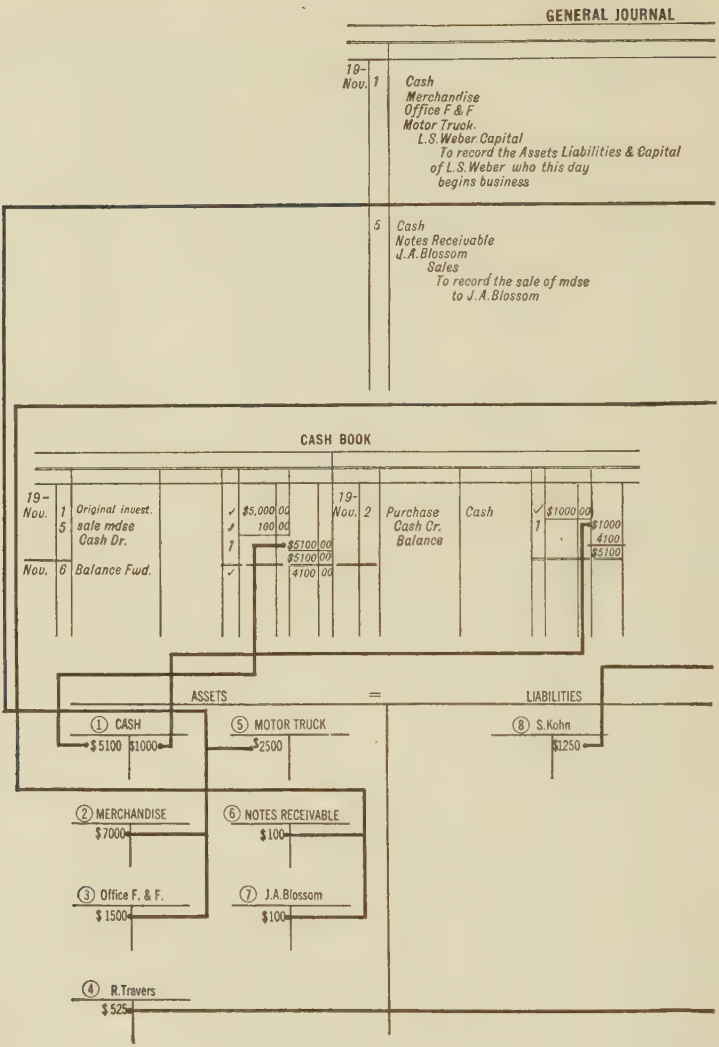
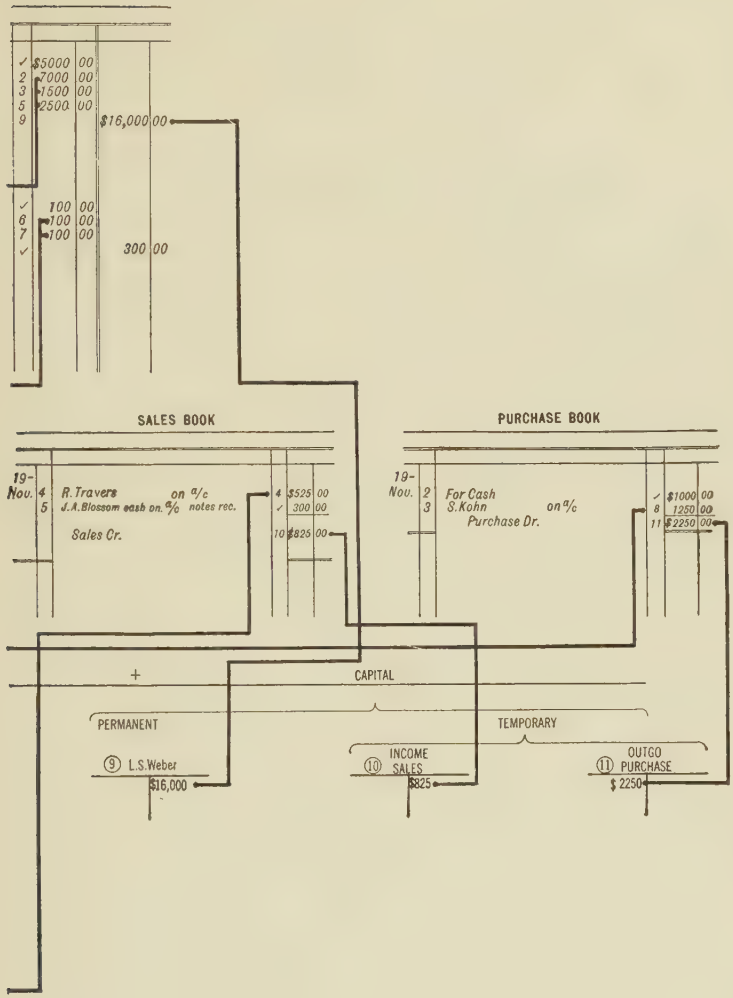


FIG.
Solution to


$5000 00
7000 00
1500 00
2500 00
$16,000 00
100 00
100 00
100 00
300 00
SALES BOOK
19-
Nov. 4 R. Travers on a/c $525 00
5 J.A. Blossom cash on a/c notes rec. 300 00
Sales Cr. 10 $825 00
PURCHASE BOOK
19-
Nov. 2 For Cash $1000 00
3 S. Kohn on a/c 8 1250 00
Purchase Dr. 11 $2250 00
+
CAPITAL
PERMANENT
TEMPORARY
⑨ L.S. Weber
$16,000
INCOME
⑩ SALES
$825
OUTGO
⑪ PURCHASE
$ 2250

15.
Problem 2.

CASH L–1

19—						19—					
Oct.	31		C.B.–1	$3,777	65	Oct.	31		C.B.–2	$ 558	25
Nov.	30		C.B.–1	794	25	Nov.	30		C.B.–2	546	50

Cash Account Solution to Problem 1.

Other accounts are obvious and are therefore omitted in this solution.

Problem 2. Problem to Illustrate Handling of a Mixed Transaction.

It should be borne in mind that mixed transactions are the exception rather than the rule, and they are made conspicuous in this text because they are harder to handle and not because they are numerous.

The following problem and its diagrammatic solution and explanation further serve to illustrate the mixed transaction.

In a system consisting of a General Journal, Purchase Journal, Sales Journal, Cash Book, and General Ledger, show how the following transactions would be entered and posted.

Nov. 1. L. S. Weber began business investing cash, $5,000; merchandise $7,000; office furniture and fixtures, $1,500; motor truck, $2,500.

2. Purchased merchandise for cash, $1,000.

3. Purchase $1,250 merchandise, on account, from S. Kohn.

4. Sold $525 merchandise, on account, to R. Travers.

5. Sold $300 merchandise to J. A. Blossom, cash $100; notes receivable, $100; and $100 on account.

Make a sketch of the system and show by lines how the various postings find their way to the ledger (Diagrammatic Ledger). Number accounts consecutively and show numbers in folio columns. See solution to Problem 2 (Fig. 15).

SUMMARY

In Chap. VIII the following accounting points were emphasized:

1. The Sales Book, Purchase Book, and Cash Book are labor-saving devices of modern accounting and their operation is based upon the principle of the compound-journal entry.

2. The General Journal is added to the line of books of original entry to care for entries not covered by the Special Journals.

3. When a transaction occurs involving two special books, check marks (√) are used which mean *do not post individually*, as the items considered are included in the totals.

4. An approved procedure for handling mixed transactions is as follows:
   a. Enter it completely in the General Journal.
   b. Enter the items covered by the special books in the special books.
   c. Make all postings from the General Journal, checking items both in General Journal and in the special books to prevent double postings.

CHAPTER IX

PROCEDURE OF ACCOUNTING FOR CASH, PETTY CASH, TRADE DISCOUNTS, AND CASH DISCOUNTS

OBJECT OF CHAPTER: (*a*) to develop the "double record" principle of checking cash; (*b*) to develop the imprest method of keeping petty cash; (*c*) to show necessity and use of internal check; (*d*) to show how Trade and Cash Discounts affect the operation of accounts.

Checking Cash by the "Double-Record" Method.[1]

Before going further into accounting mechanism, it will be well to consider several points of vital importance suggested in Chap. VIII. These questions are procedures of accounting for Cash, Petty Cash, Trade Discounts, and Cash Discounts.

Checking cash is recognized as being of fundamental importance, and the widely accepted method of depositing all receipts in the bank and disbursing cash only by check must necessarily receive emphasis at this point.

This method provides two records, the bank statement and the Cash Book which must check each other after adjustments are made for outstanding checks, bank interest received, and protest fees.

To get this procedure clearly in mind, reference should be made to Fig. 16. The following data may be assumed.

Cash Book balance at close of business, Jan. 15, 19—, $1,108.98.
Outstanding checks are No. 1, $50.12; No. 5, $30.90; No. 12, $60.12.
Balance as shown by Bank Statement is $1,250.12.

During the period under consideration, all receipts of cash were entered on the left side of the Cash Book and deposited in the bank at the close of each day's business. All disbursements were entered on the right side of the Cash Book and were made through properly numbered checks. The bank balance shows on Jan. 15, $1,250.12, but, on checking up on issued checks, it is found that checks Nos. 1, 5, and 12 are still outstanding. A reconciliation is necessary, and usually takes the form of a state-

[1] KESTER, R. B., "Accounting Theory and Practice," Vol. 1, Chap. XLI, 1922.

ment, such as shown in Fig. 16. When the outstanding checks have been deducted, the bank statement balance must check with the balance of the reconciliation statement. The value of this check lies in the fact that the two records are kept entirely independent of each other.

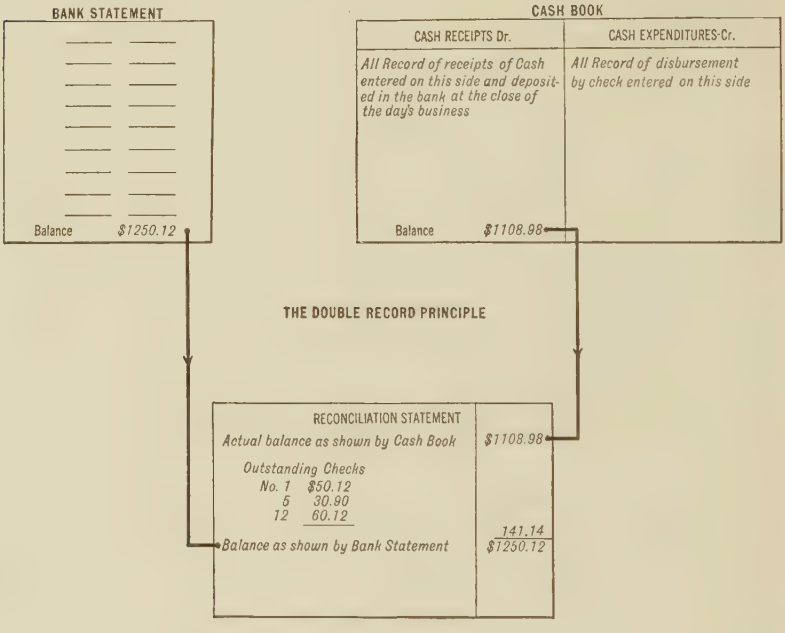

BANK STATEMENT
Balance $1250.12
CASH BOOK
CASH RECEIPTS Dr.
CASH EXPENDITURES-Cr.
All Record of receipts of Cash entered on this side and deposited in the bank at the close of the day's business
All Record of disbursement by check entered on this side
Balance $1108.98
THE DOUBLE RECORD PRINCIPLE
RECONCILIATION STATEMENT
Actual balance as shown by Cash Book $1108.98
Outstanding Checks
No. 1 $50.12
5 30.90
12 60.12
141.14
Balance as shown by Bank Statement $1250.12

Fig. 16.

Petty Cash: The Imprest System.

While the issuing of checks is a proper and workable method of handling cash expenditures, it is nevertheless impracticable to issue checks for such petty items as postage stamps, car fare, entertainment of customers, etc. To overcome this difficulty, the custom is usually adopted of restricting the issuing of checks to a certain minimum figure and to care for all expenditures below this figure from a petty cash fund set up especially for that purpose.

Imprest means "to make an advance" and, under the imprest system, an "advance" is made by the general cashier to the petty cashier in the form of a check for the amount of the petty cash fund. At this time cash is credited in the cash book, the explana-

tion being "To set up a petty cash fund"; the debit being to the petty cash account in the ledger.

The petty cashier cashes the check and proceeds to operate as follows: For every expenditure he obtains a receipt, voucher, or record of some sort for the outlay of money. At any time then, the amount of money in the petty cash drawer + the amount of the expenditure in the form of receipts, etc. must = the total amount of the petty cash fund.

This is the fundamental principle of the imprest system.

When the fund gets low, the petty cashier presents a record of his expenditures to the general cashier and obtains a check for their exact amount. Adding this check to the money in the petty cash drawer brings the petty cash fund up to its original amount. The general cashier will credit Cash, and debit the various items of expense as given on the petty cash record through the Cash Book. If a petty cash book is kept, the debits to the various expense items may be made from that book, as shown in the following problem and illustration.

The operation of the imprest method of keeping petty cash may be followed by working a typical problem.

Problem 1. To Illustrate Use of Imprest Method.

Let it be assumed that the firm decides to set up a petty cash fund of $50. The entry will be made in the Cash Book as:

	Dr.
Petty Cash, Check No. 60 to establish petty cash fund	$50

This will, at the time of posting, find its way to the debit side of the Petty Cash account in the ledger as shown by the arrows and connecting lines in Fig. 17. The credit will of course be included in the total posting to the credit side of Cash.

Let it further be assumed that the petty cashier keeps a Petty Cash Book and enters therein all expenditures made from the petty cash fund. If the following named expenditures were made,

Jan. 2. Stationery and Stamps	$ 8.12
4. Repairing window	6.50
6. Cleaning and waxing floor	8.90
25. Entertaining customers	10.80,

they would be recorded in the Petty Cash Book as shown in Fig. 17.

At certain regular periods the fund must be replenished and it may be assumed that, on Feb. 1, the petty cashier totals his Petty Cash Book and calls upon the general cashier for reimbursement for the amount expended during the period. This amount is as shown in the illustration, $34.32. This check will be duly drawn, cashed, and added to the balance of $15.68, thus bringing it up to the original amount of $50. The postings to the various expense accounts may be made under this procedure directly from the Petty Cash Book totals to the proper expense

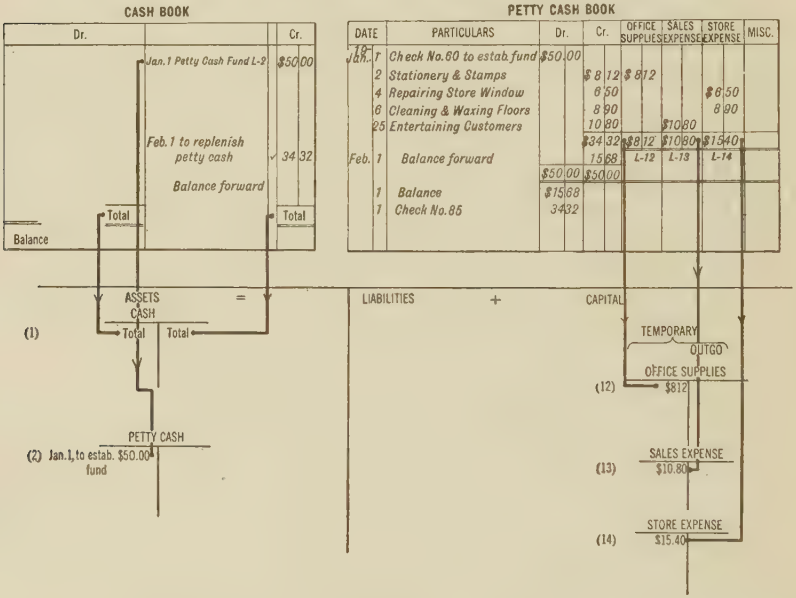


Fig. 17.

accounts in the ledger. The general cashier will record in the Cash Book,

Miscellaneous Expenses per Petty Cash
Book—Check No. 85 to Replenish Petty Cash Fund.....✓. $34.32.

The check denotes, of course, that no posting to expense accounts is to be made from the Cash Book, that procedure being carried out from the Petty Cash Book, as shown by references L12, L13, L14, in the petty cash totals.

Internal Check.

While the best form of check is, of course, the honor and trustworthiness of the employee, it is nevertheless a good business

policy to reduce the temptation of even petty thievery to a minimum. If the same person opens the mail, receives and lists all incoming cash, keeps the books, and makes deposits in the bank, the chance for fraud is great.

To eliminate such temptations a system of internal check should be employed.

> Such a system consists in the accounting records, methods, and details generally of an establishment being so laid out that no part of the account or procedure is under the absolute and independent control of any one person; that, on the contrary, the work of one employee is complementary to that of another; and that a continuous audit is made of the details of the business.[1]

Trade Discounts.[2]

Discounts on sales and purchases are of two kinds, trade discounts and cash discounts. In the complexity of modern business an article is generally quoted at a certain "list price" subject to certain trade discounts. In this way, the exact terms may be kept secret and it is possible to quote different prices to different customers.

Let it be assumed that the list price of a certain article is $85, subject to the following discounts of 20%, 10% and 8% off. The wholesaler receives all three discounts, the jobber the first two, and the retailer receives only the first discount.

(1) Wholesaler's price, ($56.30)
$85.00 less 20% = $17.00 discount; $85.00 − $17.00 = $68.00
$68.00 less 10% = $ 6.80 discount; $68.00 − $ 6.80 = $61.20
$61.20 less 8% = $ 4.90 discount; $61.20 − $ 4.90 = $56.30
(2) Jobber's price, ($61.20)
$85.00 less 20% = $17.00 discount; $85.00 − $17.00 = $68.00
$68.00 less 10% = $ 6.80 discount; $68.00 − $ 6.80 = $61.20
(3) Retailer's price, ($68.00)
$85.00 × 20% = $17.00 discount; $85.00 − $17.00 = $68.00
(4) Customer's price,
$85.00

[1] MONTGOMERY's "Auditing, Theory and Practice," Vol. 1, p. 62.

[2] KESTER, R. B., "Accounting Theory and Practice," Vol. 1, Chap. XLIV, 1922.

It should be noted that the discount in each case is a percentage of the remaining value. The total discount to the wholesaler, for example, would be calculated as follows:

$$.20 + .10 \text{ of } (1.00 - .20) + .08 \text{ of } (1.00 - .28) = .3376 = 33.76\%$$
$$\$85.00 \times .3376 = \$28.70$$

His price would be

$$\$85.00 - \$28.70 = \$56.30$$

or a simpler way would be to use the expression

$$(1.00 - .20)(1.00 - .10)(1.00 - .08) \times \text{gross} = \text{Net}$$
$$.80 \times .90 \times .92 \times \$85.00 = \$56.30$$

Cash Discounts.

Cash discounts are certain percentage reductions from the net selling price for the payment of cash within a certain time range. Thus the expression: 2/10, 1/30, n/60 means 2% discount if paid in 10 days, 1% discount if paid in 30 days, and net (no discount) if paid in 60 days. (The presumption being that customers who delay paying beyond the 60-day period are poor credit risks and should be so regarded in future dealings.)

Example.

A sale of merchandise is made to Ralph Jones for $2,500, terms, 2/10, 1/30, n/60. Jones pays after 5 days, thus obtaining a 2% discount. The entries would be:

Cash	
$2,450	

Sales	
	$2,500

Ralph Jones	
$2,500	$2,450
	50 discount

Sales Discounts	
Ralph Jones, $50	

It will be noted that an account known as a "Sales Discount Account" is opened directly under the Sales accounts and acts as a deduction in the final analysis.

Purchase Discounts.

Purchase discounts would be handled in a similar manner as shown in the following example.

Example.

A purchase of merchandise is made from Malley Iron Company for $300, terms, 5/10, n/30. The bill is paid within the 10-day period thus earning the discount. The entries would be,

Cash		Malley Iron Company		Purchases	
	$285	$285 discount 15	$300	$300	

Purchase Discount	
	$15 Malley Iron Company

The following important points are to be noted. Cash discounts are figured on the *net selling price.* All *trade discounts* are deducted from the list price when the bill is received because their deduction depends upon no chance, such as a time limit in meeting the payment of the bill.

Cash discounts may or may not, however, be taken by the buyer and, therefore, should not be deducted from the face of the bill. If payment is made within the time limit allowed, the reduction is made.

SUMMARY

In Chap. IX, the following accounting points were emphasized:

1. The double-record principle of bank statement and cash book are fundamental in modern business control of cash.

2. The imprest system consists in "making an advance" to a petty cashier who is periodically reimbursed for the amount of his expenditures. At any time the amount of petty cash on hand, plus a record of expenditures, must equal the total of the petty cash fund originally created.

3. It is important to have employees check each other's work, thus developing a system of internal check that makes dishonesty difficult.

4. Trade discounts are quoted as certain percentage reductions from the list price, and the percentage in each case applies to the remaining amount. They usually read $85 — 20%, 10%, 8% off.

5. Cash discounts are given if a payment is made within a certain time limit. They usually read $200 — 2/10, 1/20, n/30.

6. Cash discounts are figured on the net selling price, all trade discounts being first deducted.

CHAPTER X

CONTROLLING ACCOUNTS

OBJECT OF CHAPTER: (*a*) to show the extension of the principle of division of labor to the ledger; (*b*) to show the ability to obtain executive control by segregating certain detail accounts and working through controls; (*c*) to illustrate the principal types of controlling accounts.

Subdivision of the Ledger.

In Chap. VIII, the Journal was subdivided into its various special books of original entry, gaining thereby in specialization, speed, accuracy, etc.

The same principle may be extended to the ledger (see Fig. 18*A*). As the number of accounts in the ledger become greater and greater, one bookkeeper finds it impossible to handle all the work. If an assistant were employed, the two would not be able to work conveniently on the same book at the same time. To solve this problem, certain accounts which deal with the same class of things as, for example, Accounts Receivable and Accounts Payable, may be removed from the ledger and placed in separate books called "subsidiary ledgers" (see Fig. 18*B*). "The best organization of work is to have one person responsible for the accuracy of one record." To represent this group of segregated accounts an account known as a "Controlling Account" or a "control" is placed in the General Ledger which represents *in total* the accounts delegated to an assistant in the subsidiary ledger. It is a sort of "proxy" in the General Ledger for the details given at the same time in the subsidiary ledger.

A further very material advantage is gained by very greatly reducing the number of items in the trial balance of the General Ledger. Details which in most cases will contain errors, are localized in the subsidiary ledgers. If then the General Ledger trial balance balances, it may be assumed correct and the statements taken off. The mechanism of the controlling account thus becomes of the utmost importance to the executives of the company. Usually, they are required to make rapid decisions,

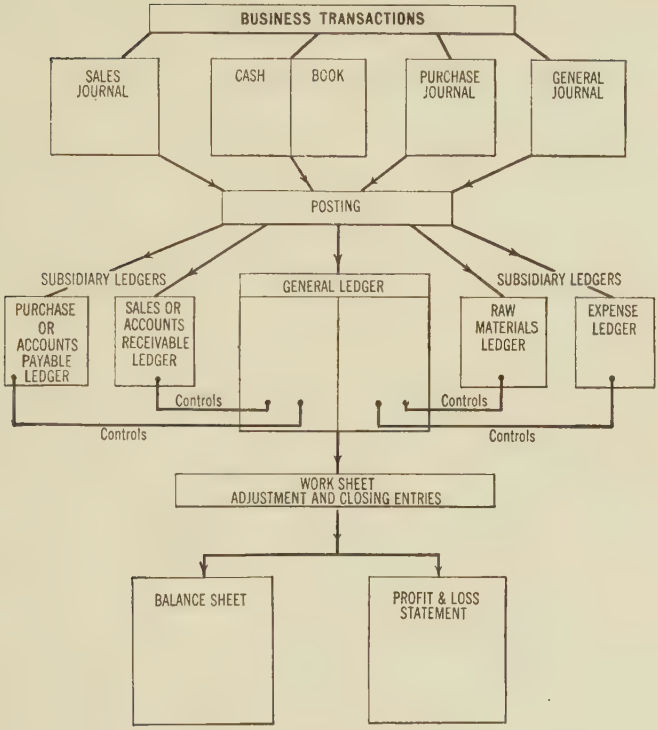


FIG. 18A.—Diagram to illustrate controlling accounts.

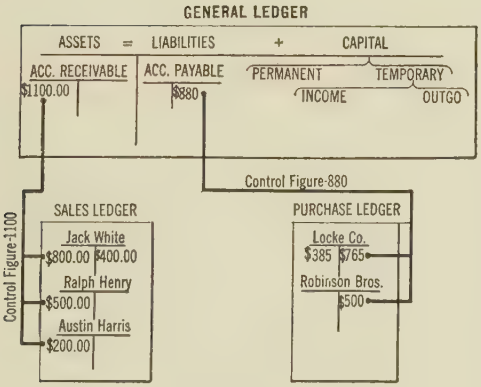


FIG. 18B.

and the wading through hundreds or even thousands of detail accounts would greatly handicap them. By the use of "Controls" they can reach important decisions on the General Ledger showing, and statements can be gotten out long before the subsidiary ledgers are proved.

Certainly, the Controlling Account is the backbone of modern accounting and it is hard to perceive how a large trading business or particularly a manufacturing industry could get along without it (see Fig. 19).

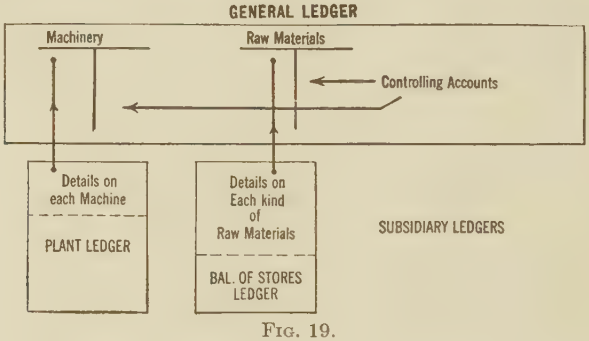


Fig. 19.

Definition of a Controlling Account.

With these facts clearly in mind, a controlling account may be defined as follows:

A controlling account is an account in the General Ledger which contains, in total, information which appears *at the same time* in detail in a subsidiary or auxiliary ledger.

Its mathematic basis is merely this, that the whole is exactly equal to the sum of all its parts, the balance of the controlling account being equal to the total of all the detail accounts in the subsidiary ledger.

Principal Kinds of Controlling Accounts.

The controlling account principle may be applied to any set of accounts of the same kind which warrant segregation. There are certain kinds however with which every executive should be familiar, and it is the aim of this chapter to present these in the clearest light possible. They are:

1. Accounts Receivable Controls
2. Accounts Payable Controls
3. Notes Receivable Controls
4. Notes Payable Controls

(see Fig. 20)

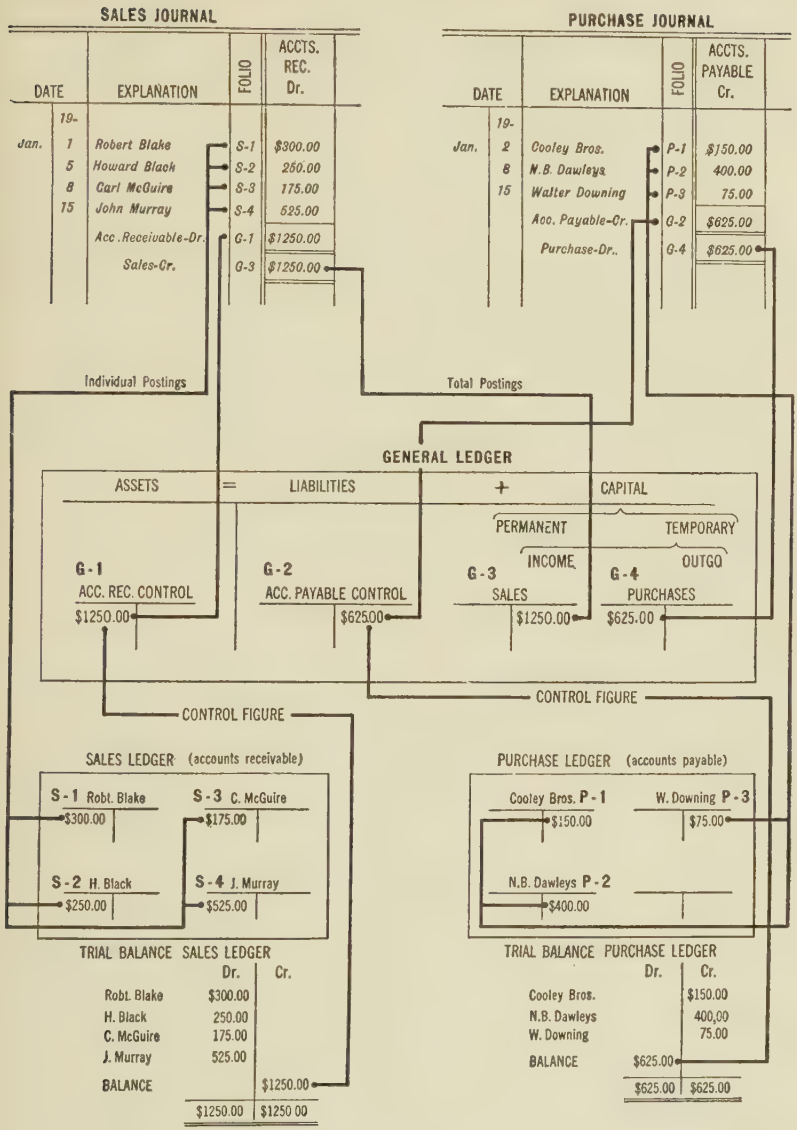

SALES JOURNAL
DATE
EXPLANATION
FOLIO
ACCTS. REC. Dr.
19-
Jan. 1 Robert Blake S-1 $300.00
5 Howard Black S-2 250.00
8 Carl McGuire S-3 175.00
15 John Murray S-4 525.00
Acc. Receivable-Dr. G-1 $1250.00
Sales-Cr. G-3 $1250.00
PURCHASE JOURNAL
DATE
EXPLANATION
FOLIO
ACCTS. PAYABLE Cr.
19-
Jan. 2 Cooley Bros. P-1 $150.00
8 N.B. Dawleys P-2 400.00
15 Walter Downing P-3 75.00
Acc. Payable-Cr. G-2 $625.00
Purchase-Dr. G-4 $625.00
Individual Postings
Total Postings
GENERAL LEDGER
ASSETS = LIABILITIES + CAPITAL
PERMANENT
TEMPORARY
INCOME
OUTGO
G-1 ACC. REC. CONTROL $1250.00
G-2 ACC. PAYABLE CONTROL $625.00
G-3 SALES $1250.00
G-4 PURCHASES $625.00
CONTROL FIGURE
CONTROL FIGURE
SALES LEDGER (accounts receivable)
S-1 Robt. Blake $300.00
S-3 C. McGuire $175.00
S-2 H. Black $250.00
S-4 J. Murray $525.00
PURCHASE LEDGER (accounts payable)
Cooley Bros. P-1 $150.00
W. Downing P-3 $75.00
N.B. Dawleys P-2 $400.00
TRIAL BALANCE SALES LEDGER
Dr. Cr.
Robt. Blake $300.00
H. Black 250.00
C. McGuire 175.00
J. Murray 525.00
BALANCE $1250.00
$1250.00 $1250.00
TRIAL BALANCE PURCHASE LEDGER
Dr. Cr.
Cooley Bros. $150.00
N.B. Dawleys 400.00
W. Downing 75.00
BALANCE $625.00
$625.00 $625.00

FIG. 20.

5. Factory Ledger Controls (see Fig. 22).
   - *a.* Perpetual Inventories Controls
   - *b.* Expense Ledgers Controls
   - *c.* Plant Ledgers Controls

   } Subcontrols
6. Private Ledger Controls

The operation of the first four types of controlling accounts listed may now be studied. Using Accounts Receivable as an illustration, it may be shown how they may be taken out of the General Ledger and placed in the Accounts Receivable Ledger or Customers' Ledger. This Ledger is more often known as the Sales Ledger. In posting under this plan, the double-posting process is carried on, *i.e.*, details are daily carried to the Customers Ledger and totals are posted monthly to the controlling account. In this way, at the end of the month, the *balance of the Customers' Ledger* should, in the absence of errors, equal the balance of the Controlling Account (see Fig. 20).

In exactly the same way Accounts Payable, Notes Receivable, Notes Payable, and other accounts of a similar nature may be handled.

Self-balancing Ledger.

In the preceding discussion the Sales Ledger had a debit balance, which, assuming a correct balance, checked with the total of the control account. A large number of prominent writers in this field do not approve of the subsidiary ledgers operating with a debit or credit balance, but favor the so-called self-balancing ledger. This is accomplished as shown in Fig. 21.

A control account called a General Ledger Control or simply a Balance Account is introduced into the subsidiary ledger which is a duplicate of the Accounts Receivable Control in the General Ledger with *this important difference;* the sides are reversed. In this way, the subsidiary ledger provides internal proof of its correctness, *i.e.*, it is self-balancing.

There are two methods of accomplishing this balance: (1) The monthly method, (2) the daily method.

In the monthly method, the postings are made in the regular way. At the end of the month when the total from the books of original entry are posted to the *Accounts Receivable Control in the General Ledger*, the same amount is posted to the *opposite side of the Balancing Account* in the Customers' Subsidiary Ledger. In the General Ledger the posting is a *debit*, while in the Customers

Ledger it is a *credit.* In the case of *Accounts Payable,* the procedure would be exactly the same but the entries would be reversed.

In the daily method, as its name signifies, the balance is made daily. When the Customers' Ledger is posted, the amounts are

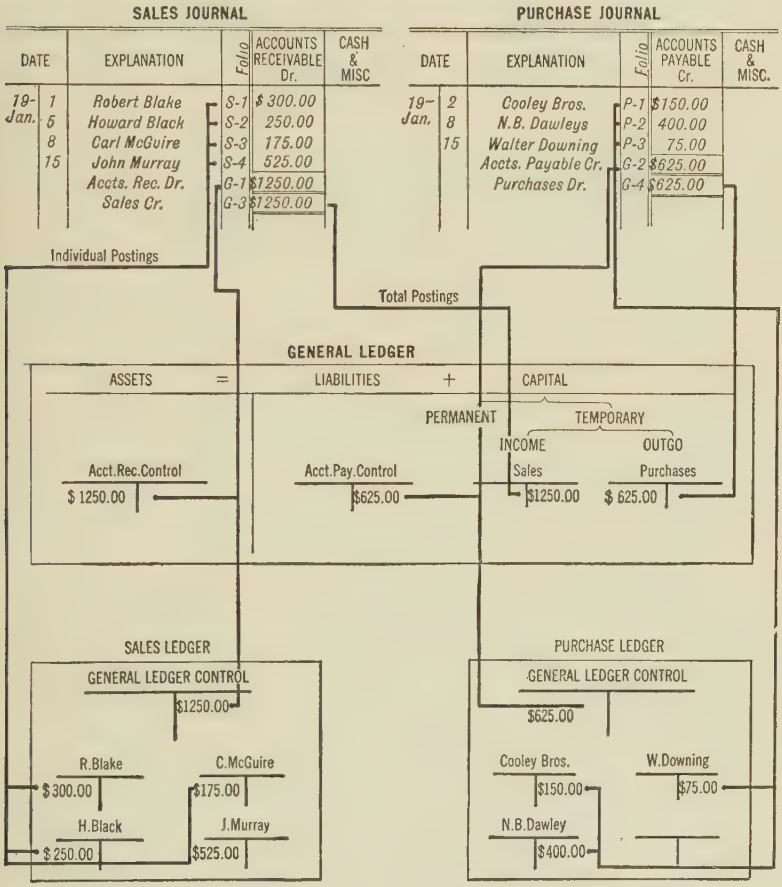


FIG. 21.

listed on a separate sheet, and, at the end of the day, these sheets are totaled and the totals posted to the Balancing Account. This method has the advantage of detecting error before the end of the month.

Extension of Self-balancing Ledger Principle.

1. *The Factory Ledger.*—In a manufacturing business it is often necessary to keep a separate Factory Ledger and to tie

this into the General Ledger by means of a controlling account. This "tying in" is quite important to the modern executive because it enables him to obtain complete information from his general books.

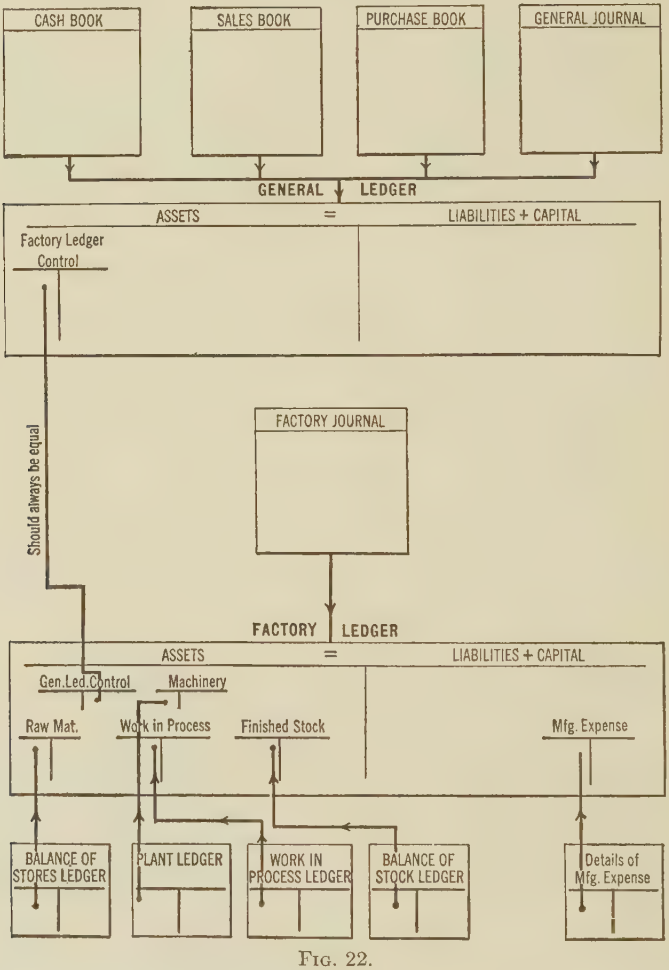


FIG. 22.

Figure 22 illustrates this scheme and also shows other important subdivisions of the controlling account principle such as Perpetual Inventory Controls, Expense Ledger Controls and Plant Ledger Controls for machinery.

A description of this plan will clear up several valuable points on controlling accounts. It is often desired to operate a separate

factory ledger either from the point of view of organization or physicial separation (the general offices may be in one city and the factory in another). A *Factory Ledger Control Account* is opened in the General Ledger and its reciprocal, a *General Ledger Control Account* is opened in the Factory Ledger.

Through the books of original entry, various entries will find their way into the General Ledger and entries of the following nature made:

Materials purchased....	Debit, Factory Ledger Control Credit, Vouchers Payable or Cash
Factory payroll.....	Debit, Factory Ledger Control Credit, Cash
Manufacturing expenses	Debit, Factory Ledger Control Credit, Cash

In this way, the Factory Ledger Control would be charged with all elements of the cost of manufacture.

A separate book of original entry known as the "Factory Journal" (a subjournal) is used to assemble the items to be posted to the factory ledger. For example:

Materials received.....	Debit, Raw Materials Credit, General Ledger Control
Factory payroll.....	Debit, Direct Labor Debit, Individual Labor, etc. Credit, General Ledger Control
Manufacturing expenses	Debit, Detail Expense Accounts Credit, General Ledger Control

In this manner, the two control accounts should be exactly the same except that the entries would be reversed.

At the end of the accounting period, the manufacturing cost of sales would be transferred to the general books from the factory books and the statements taken off from the general books. A more detailed discussion with a solution of a typical problem will be given in Chap. XIII.

This diagram further illustrates various subcontrolling accounts. The Raw Material Work-In-Process and Finished Stock Controls are totals of the Perpetual Inventory Accounts that are kept in the subsidiary ledgers. The Machinery Control

Account represents the total of all the pages of the Plant Ledger, there being one page for each machine (see Fig. 60, Chap. XVI).[1]

The Manufacturing Expense Control handles, in totals, the "break down" of the various manufacturing expenses kept in the form of subsidiary ledgers or analysis sheets.

It is intended at this point merely to present the controlling account principle as applied to the Factory Ledger. Detailed discussions and solutions will be given in Chap. XIII "Accounts and Statements of a Manufacturing Business."

The Private Ledger.

This same principle may be used when it is desired to keep the general bookkeeper in ignorance of certain facts. In any organization such items as special discounts to customers, officers' salaries, etc. are at times intrusted to a confidential officer. Figure 23 illustrates such a set-up. Information of a confidential nature is entered in the books of original entry *without explanation*, credits being to various accounts, usually cash and debits to the Private ledger control. Thus in the Private Journal these entries are made with full explanation, the debits being to the various confidential accounts and the credits to the General Ledger Control. At closing time, the General Ledger information is closed into the Private Ledger where profits are figured and statements taken off.

Effect of Controlling Accounts on Books of Original Entry.

In order to secure the desired totals for controlling accounts, certain changes must be made in the books of original entry. In the last chapter, the principle of columnar development, touched on in connection with the special books, now becomes of greater importance in studying controlling accounts.

The books of original entry may be designed to give almost any reasonable totals by merely adding sufficient columns and entering therein the items desired.

A valuable illustration of this nature is the expansion of the previously studied two-column Cash Book into a four-column Cash Book.

In Fig. 24 is illustrated a common type of four-column, self-balancing Cash Book. When controlling accounts are kept

[1] See also KIMBALL, D. S., "Principles of Industrial Organization" 3rd ed., p. 344.

for Accounts Receivable and Accounts Payable, the total of the Accounts Receivable Column is *credited* to its General

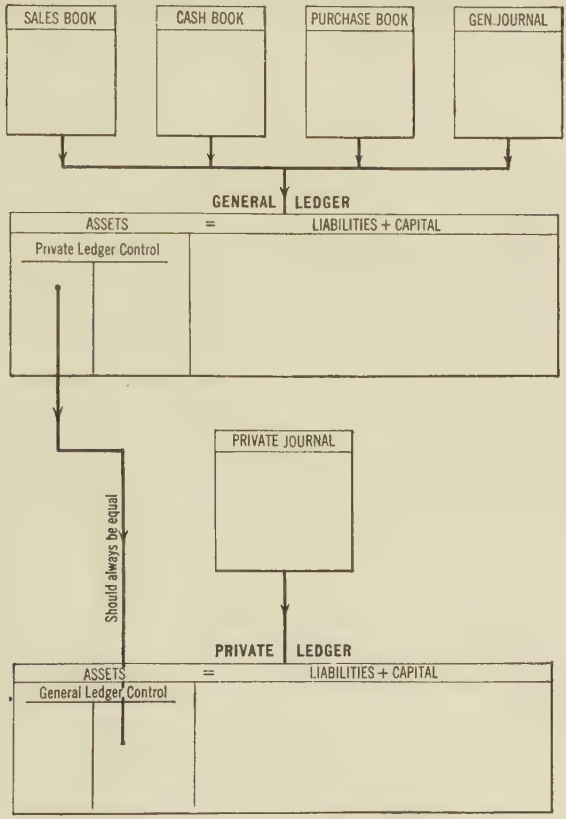


Fig. 23.

4 COLUMN SELF-BALANCING CASH BOOK

	1	2	3	4			A	B	C	D
ACCOUNT TO BE CREDITED	Sundry Credits	Accts. Receiv. Cr.	Sales Discount Dr.	Net Cash Dr.		ACCOUNT TO BE DEBITED	Sundry Debits	Accts. Payable Dr.	Purchase Discount Cr.	Net Cash Cr.

Fig. 24.

Ledger Account at the end of the period, and the total of the Accounts Payable Column is *debited* to its General Ledger Account. Individual postings are made daily as required.

This type of Cash Book is self-balancing in that
The sums of columns 1 + 2 = the sums of columns 3 + 4 and the sums of columns $A + B$ = the sums of columns $C + D$

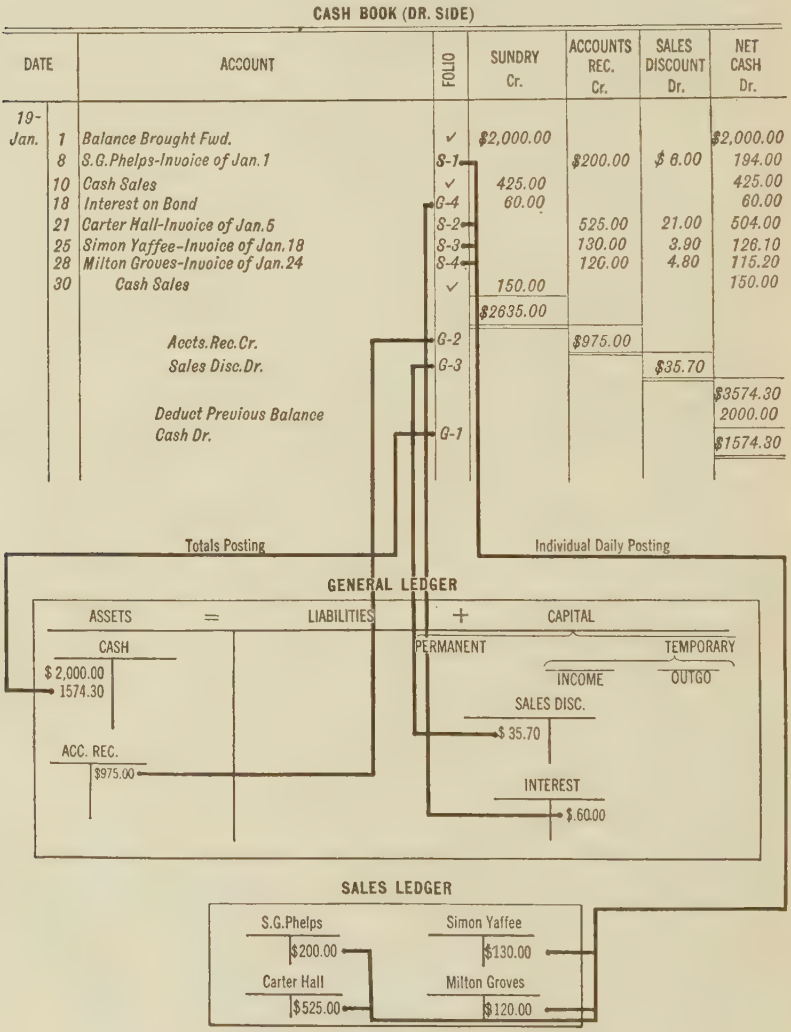


FIG. 25.—Solution to Problem 1.

Problems 1 and 2 which follow will illustrate its use as well as the application of columnar development to the Sales and the Purchase Journals.

Problem 1.

The routine entries of a Cash Book are to be posted to a General Ledger Controlling Account and the details placed in a subsidiary ledger. The diagrammatic solution illustrates the procedure (see Fig. 25).

Problem 2.

Make proper entries for the following transactions in a Cash Book, Purchase Journal, Sales Journal, and General Journal.[1]

Open the proper accounts in a General ledger, Sales ledger, and Purchase ledger and make the proper entries.

On Jan. 1, 19—, A. H. Church began business investing $3,000, in cash, and $3,000 in bonds.

2. He bought a delivery truck for $1,800 paying $200 in cash and carrying the balance on account; purchased $650 merchandise for cash.
4. Cash sales $375; sold $105 merchandise to James Green, on account.
6. Paid office salaries $25; rent for the month $150.
8. Purchased $560 merchandise from R. Fiske, on account.
10. Sold $125 merchandise to R. Carter, on account.
12. Sold $75 merchandise to Walter Stone, on account.
15. Purchased $625 merchandise from G. Kammerer, giving $150 in cash and carrying the balance on account.
16. Delivery truck expenses, $35.
17. Paid R. Fiske $500, on account.
18. Received $75 from R. Carter, on account.
20. Cash sales, $150.
23. Sold $150 merchandise to R. Carter, receiving $100 in cash, balance on account.
24. Paid G. Kammerer $300, on account.
26. Received $75 from James Green.
30. Paid office salaries of $50 (see Fig. 26).

SUMMARY

In Chap. X, the following accounting points were emphasized:

1. Controlling accounts show in total in the General Ledger information which is shown, *at the same time*, in detail in a subsidiary or auxiliary ledger.
2. The controlling account principle is the backbone of accounting in large industries.
3. The most usual types of controlling accounts are:
   a. Accounts Receivable Controls
   b. Accounts Payable Controls
   c. Notes Receivable Controls
   d. Notes Payable Controls
   e. Factory Ledger Controls
   f. Private Ledger Controls

[1] See WOODBRIDGE, F. W., "Solutions to Problems for Elements of Accounting."

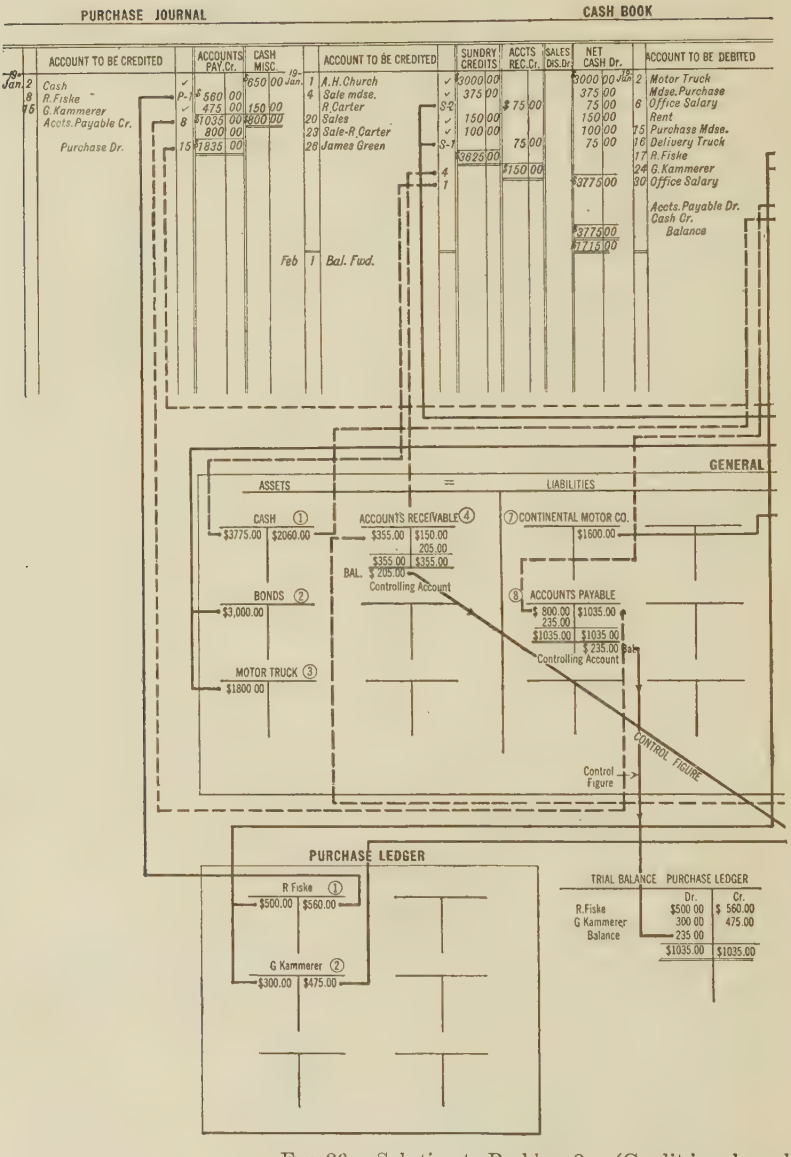
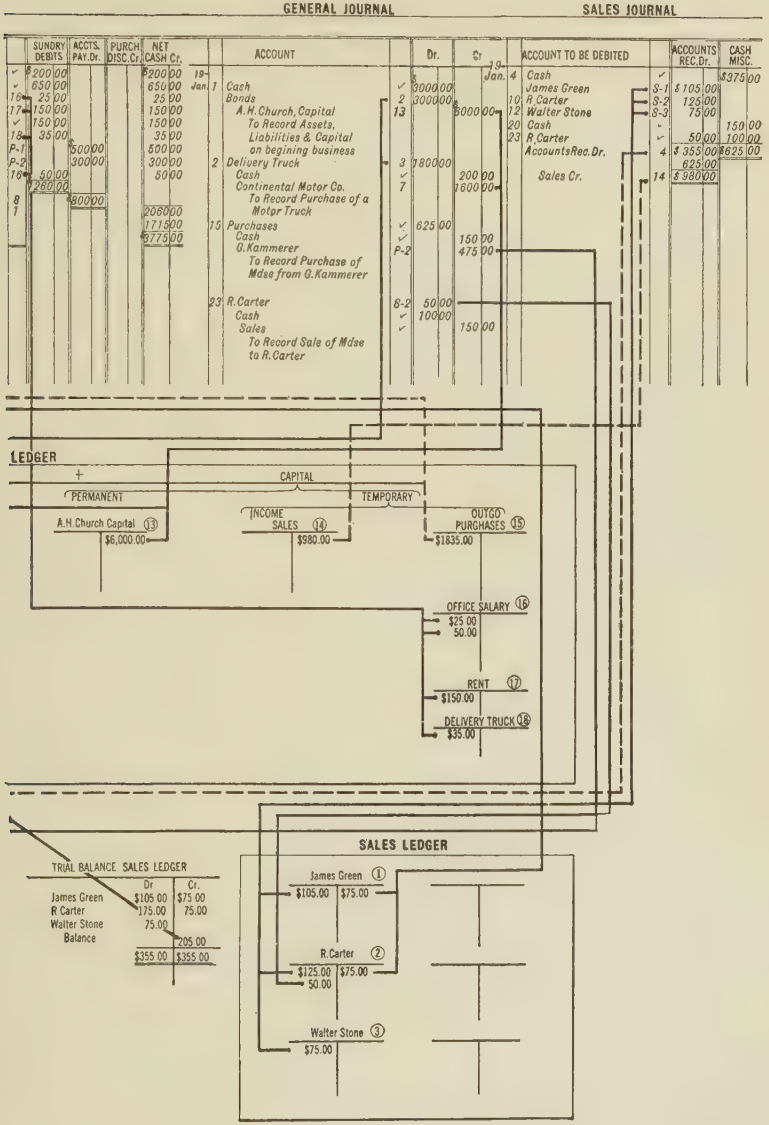


FIG. 26.—Solution to Problem 2. (Credit is acknowl-

4. The Self-balancing ledger is a development of the controlling account principle, and consists of introducing a control account called a General Ledger Control or simply a Balance Account into the subsidiary ledger which is a duplicate of the Control Account in the General Ledger, with *this important difference*, the sides are reversed.



edged to Woodbridge, F. W.—Solution to Problems.)

5. The self-balancing principle is of great advantage in operating the accounts of an industry (see Fig. 22).

6. Where secrecy of accounts is desired, the control and self-balancing principles have been applied to develop a Private ledger.

CHAPTER XI

THE VOUCHER SYSTEM

OBJECT OF CHAPTER: To develop a new record which will extend the principle of the purchase journal to cover all expenditures

Need of a New Type of Record.

As the size of the business increases, and particularly if it is of a manufacturing nature, certain needs arise which the records studied in the first ten chapters do not fulfill. In a manufacturing business the successful executive must keep under constant review:

1. The quantities and costs of material consumed in making the product.
2. The labor applied directly to it.
3. The expense of manufacture segregated into its various parts. These requirements added to the already voluminous list of factors involved in an ordinary trading business create the demand for a system which will:

1. Extend the principle of the purchase journal to a point where it will include *all transactions* requiring the expenditure of cash.
2. Furnish, at least in summary form, a record which will give an up-to-date record of all liabilities at the *time they are assumed* (not just when payment is made).
3. Certify to the accuracy of an invoice by having a responsible person check it and show authority for payment by having a higher executive approve it.
4. Properly distribute the various expenditures to the accounting records in accordance with the company's classification scheme by having the proper person duly authorize it.

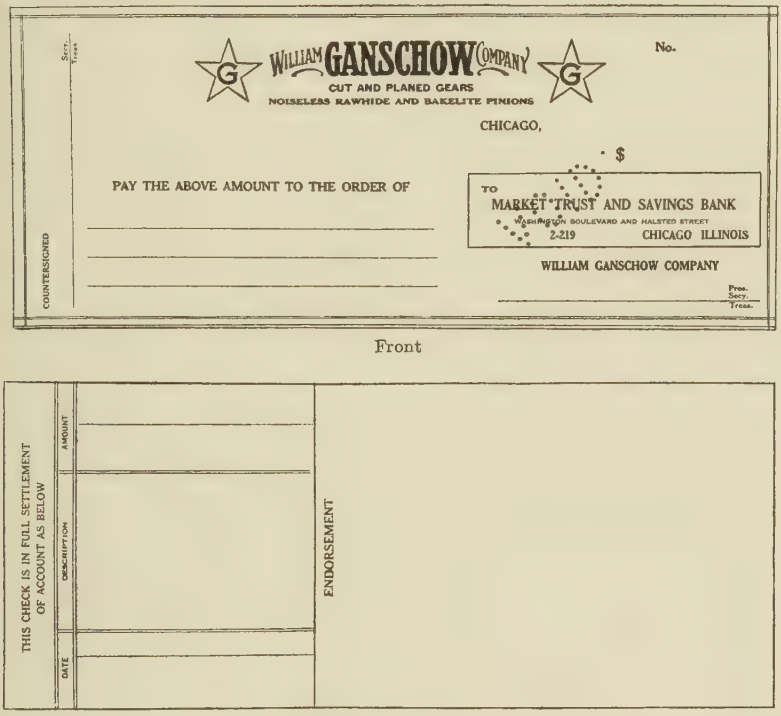
Evolution of the Voucher System.

To meet these needs the voucher system was evolved. Webster's New Standard Dictionary defines voucher as:

. . . A book, paper or other thing which serves to vouch the truth of accounts or to confirm and establish facts of any kind, specifically any

receipt or the like showing payment of a debt; as paid checks are his vouchers.

Modern business has laid particular emphasis on the authorization and approval function implied in this definition. Before an invoice is paid, authority must be had from a duly responsible executive and the charges to the various accounts must receive his approval.



Front

Reverse

FIG. 27.—Voucher check.

The voucher system consists of:

1. A printed form, known as a "Voucher," showing the payment of a particular item of goods with its distribution into proper accounts. In modern business this is combined with the check, used for payment, and the combined document is known as the "Voucher Check" (see Fig. 27).

2. The Voucher Register (see Fig. 28) is a journal with proper distribution columns into which the amount of the voucher, its

distribution, etc., are recorded. It is really an enlarged Purchase Journal.

Procedure under the Voucher System.

1. Invoice is received and held awaiting arrival, inspection, and acceptance of goods.

2. Voucher or Voucher Check is made out either singly or in duplicate showing amount, discount deductions, if any, and proper distribution (see Fig. 27).

3. Proper signatures for approval of payment and distribution are secured.

4. Entry is made in the Voucher Register (see Fig. 28).

5. Voucher with check attached or voucher check is mailed to creditor.

6. Return of signed Voucher or endorsed Voucher Check is received in due process and serves as proper receipt of this particular transaction.

7. From the Voucher's Payable column, distribution is made on the same line into the columns for the various accounts to be charged (see Fig. 28).

8. At the end of the month or at some other convenient period, the Voucher Register is summarized and posted, as shown in the illustrative problem which will follow.

The total of the Voucher's Payable column is credited to the Vouchers Payable Account in the General Ledger and the total of the distribution columns are debited to their accounts in the General Ledger. (Under this system the Accounts Payable by creditors is eliminated, as will be later discussed.)

Problem 1 to Illustrate Operation and Postings from Voucher Register.

Enter the following transactions in the Voucher register and post to a diagrammatic ledger.

Voucher 1. For purchase of $5,000 material from the U. S. Steel Company, terms 2/5, n/30; paid on Jan. 5, 19—, check No. 143.

Voucher 2. Prudential Insurance Company insurance for the year, 19—, $650.

Voucher 3. Factory payroll, $12,000; $10,500 direct labor, $1,500 indirect; paid on Jan. 2, 19—, check No. 142.

Voucher 4. Paid Maine Central Railroad $400 for goods shipped F.O.B. to the factory, check No. 144, Jan. 8, 19—.

Voucher 5. Paid advertising bill of $200 to Carlson Company Advertisers; check No. 145, Jan. 10, 19—.

Voucher 6. Salesmen's salaries of $1,500.

Voucher 7. For purchase of $2,000 material from the Bristol Brass Company, terms 3/10, n/30.

Voucher 8. For desks purchased for the office from Rex Company, $200; paid Jan. 11, 19—, check No. 146.

Voucher 9. Repairs on delivery equipment, $45; Baker Brothers Garage.

Voucher 10. Paper, ink, and stencils for the office from the Sampson Company, $125.

Voucher 11. For purchase, $1,000 material from the U. S. Steel Company, check No. 147, Jan. 18, 19—, terms 2/5, n/30.

Voucher 12. Payroll $1,500 Direct labor; check No. 148, Jan. 30, 19— (see Fig. 28 for Solution).

Elimination of the Creditors' Ledger.

A Creditors' ledger is sometimes of little advantage to executives. Bids are usually secured on purchases and the result is an ever-shifting group of Accounts Payable. Under the Voucher System as described, the Creditors or Purchase Ledger is omitted. Each transaction is treated independently, numbered, and entered with its proper debit and credit classification in the Voucher Register. *In fact, we may view the whole transaction by merely running the eye across one line of the Voucher Register.*

When the volume of business that is done with each creditor is desired, either a formal purchase ledger may be kept or various aphabetical or other indices of creditors may be compiled to give the desired information.

Cash Discounts on Purchases.

There are several ways of handling cash discounts on purchases depending upon the policy of the firm whose books are being kept. They may be treated as items of financial management or as purchase department items.

Probably the most workable method in handling purchase discounts under the voucher system is as follows:

a. Draw up and enter the voucher in the Voucher register for the total amount. If a discount column exists, either leave it blank or use it as a memorandum.

b. Use a discount column in the Cash Book and post all discounts to the ledger from this column.

This simple procedure may be illustrated by referring to the solution of Problem 1, Fig. 28. Let it be assumed that in paying the vouchers payable incurred, the treasurer is able to take advantage of the discounts. This would mean a cash saving of:

Voucher 1..... $5,000 × .02 = $100 (2% in 5 days.)
Voucher 7..... $2,000 × .03 = 60 (3% in 10 days.)
Voucher 11..... $1,000 × .02 = 20 (2% in 5 days.)
$180

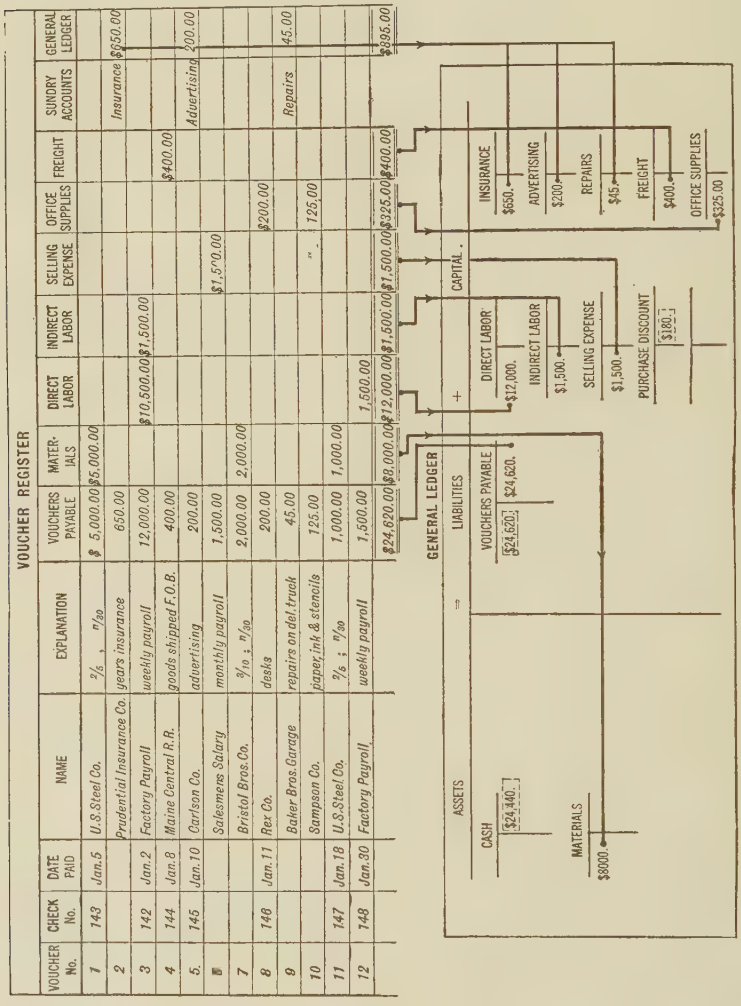


Fig. 28.—Solution to Problem 1.

The cash disbursement column of the Cash Book then would total $24,440 and the cash discount column $180. The entries as shown in the circled items of the illustration would then be:

	Dr.	Cr.
Vouchers Payable	$24,620	
Cash		$24,440
Purchase Discounts		180

Returns and Allowances on Purchases.

Returns and allowances on purchases present difficulties when the Voucher System is in use, and while several adjustment methods may be used, they are inconvenient and troublesome at the best. One of these methods consists in making small colored-ink entries on the same line as the voucher affected. These items may be totaled and treated as deductions. Another method consists in cancelling the old voucher and issuing a new one instead. These methods are clumsy, however, and if any great number occur, the voucher system may not find its best application in that form of business.

Extension of Voucher Principle.

As the business becomes larger and larger, increased emphasis is placed on the approval and authorization feature of the voucher method, so that in some companies all journal entries are made on an independently printed form and are approved by various department chiefs. Figure 8, Chap. IV, is an illustration of a Journal Voucher as used by a large manufacturing company. Where all entries require approval and are drawn up in voucher form, previous to an entry in the various books of original entry, the *Universal Voucher System* is said to be in operation. This is merely an extension of the principle discussed, to all entries because of the need of closer executive control required in large companies.

Many advantages and a few disadvantages occur under the voucher system. For some companies it is a fine thing, while for others it is absolutely inadequate. Among the advantages of the voucher system may be listed:

1. A receipted bill for all payments.
2. An up-to-date entry of all liabilities.
3. A purchase analysis in detail.
4. A saving of labor and a placing of responsibility.

Among the disadvantages that must not be overlooked if such a system is to be recommended are:

1. It is difficult to handle return allowances, partial payments, etc.
2. Information which should be confidential may get into creditor's hands.
3. The volume of business done with a particular customer *may* not be shown.

SUMMARY

In Chap. XI, the following accounting points were emphasized:

1. The Voucher System deals with each transaction independently and secures a receipt for it.

2. The Voucher Register is a modern development of the Purchase Journal.

3. The formal Creditor or Purchase Ledger is usually eliminated, thus introducing a great labor-saving function.

4. The Voucher Register is the start of a scheme of controlling all features of cost accounting procedure.

5. In large companies the function of the voucher record may be extended to include all journal entries creating what is known as the "Universal Voucher System."

6. The Voucher System may be adequate for one type of business, but entirely useless for another kind.

CHAPTER XII

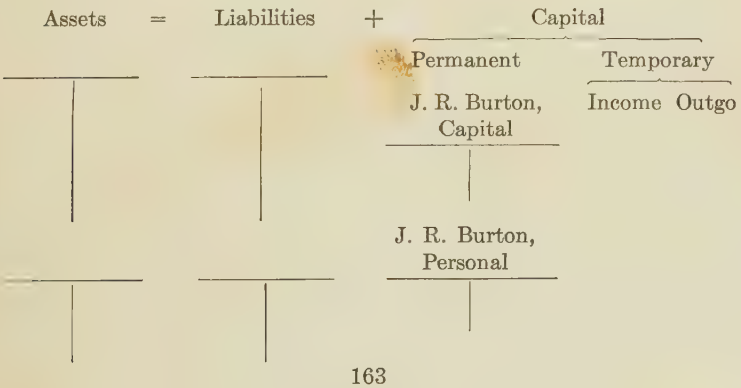
THE EXTENSION OF PROPRIETORSHIP FROM THE SINGLE PROPRIETORSHIP TO THE PARTNERSHIP AND THE CORPORATION

OBJECT OF CHAPTER: to extend the fundamental accounting principles developed in the sole proprietorship to the partnership and the corporation.

Diagrammatic Ledger of Single Proprietorship, Partnership, and Corporation.

By using the single proprietorship, most of the important accounting principles have been developed because of the simplicity of the approach. The partnership and corporation forms of organization require for their accounting merely an extension of proprietorship.

Thus, in the single proprietorship for the business of J. R. Burton it may be stated:



In the Partnership of Burton and Maxwell,

Assets = Liabilities + Capital

Capital: Permanent | Temporary (Income, Outgo)

Permanent: J. R. Burton, Capital

J. R. Burton, Personal

R. S. Maxwell, Capital

R. S. Maxwell, Personal

In the Corporation of Burton, Maxwell, and Company,

Assets = Liabilities + Capital

Capital: Permanent | Temporary (Income, Outgo)

Permanent: Capital Stock

Surplus[1]

[1] Corporations are required by law to carry a Surplus account. Profits are carried to the Surplus account, but are not added to capital stock.

Three Outstanding Forms of Business Organization.

In business, today, there are found three outstanding forms of organization, namely, the sole proprietorship, the partnership, and the corporation.

Sole Proprietorship or Individual Ownership.

In this, the oldest and simplest of organizations, upon which has been developed the accounting technique, of the preceding chapters, the proprietor is found as supreme judge subjected to very little legal regulation. He has entire authority and responsibility. Profits and losses belong to him personally. His legal liability covers all his assets whether or not they are considered a part of the business.

The Partnership.

A partnership is formed by two or more persons who invest their money and each bears his burden or active management and obligation. His services as well as his capital are invested. The exact relations and agreements that may exist between or among them may vary.

Each partner is responsible for all debts of the partnership and judgment may be rendered against the private property of the individual partners if the partnership assets will not cover its liabilities.

It is evident that it would not be wise to have too many owners in a partnership. Friction and mismanagement might result.

The Corporation.

A corporation cannot be formed without the consent of the state. After a corporation has been formed, they must conduct their business according to the requirements of the law. Each state has its own laws governing corporations.

In a corporation, individual persons furnish the capital by paying in cash or contributing other assets. The corporation is controlled by a "board of directors," which is elected by the owners. They run the business for the benefit of the owners who are called "stockholders."

The "board of directors" of a corporation elect or appoint suitable persons to manage it. These persons are paid employees of the corporation and receive salaries. If any of the owners are chosen to manage the affairs, they receive salaries just as a non-owner would. The stockholders of a corporation invest only their capital. In this respect, the corporation differs greatly from the proprietorship and the partnership.

A corporation may carry on business in its own name only. A stockholder in a corporation is, usually, not liable for its indebtedness beyond the amount of his stock.

In a partnership, no member can transfer his share of interest to anyone without the consent of the other members. In a corporation, any stockholder can sell his stock at will.

The capital of a corporation is divided into parts or shares of equal amount. The amount of the shares differs in different corporations but is more or less controlled by the laws of each state. $100 shares are, perhaps, most common. A person's investment in a corporation is spoken of as so many shares of stock, each share entitling the owner to a vote in the management of the corporation's affairs. All the shares taken together make up what is known as the "capital stock" of the corporation. The corporation issues a certificate to each owner or stockholder stating the number and face value of the shares of stock he owns.

Stocks are of two kinds, common and preferred. Common stock is the general or ordinary stock of a corporation. It has no special privileges or restrictions of any kind. Preferred stock is stock having some special preference over other kinds in the matter of dividends or assets of the corporation. A corporation may issue both common and preferred stock. On the preferred stock they agree to pay a definite dividend before any common stock can receive a dividend.

Preferred stock must not be confused, however, with a bond. Dividends of stock are paid if there is a profit made, but the interest payments on bonds must be made irrespective of the success of the enterprise. The bond, in other words, is an obligation incurred by borrowing a certain sum of money which is secured usually by mortgage of some form on the assets of the corporation. Holders of bonds and stocks, therefore, have a radically different viewpoint of the operation of the corporation.

Treasury Stock.

When stock has been issued lawfully and fully paid by a corporation and then comes back to the treasury either by purchase or donation, it is known as treasury stock. Once reacquired by the treasury this stock may be sold at any price, and its sale at a discount will not incur the liability of the balance not paid.

Authorized Stock.

Authorized salable stock is the amount stated in the certificate of incorporation. If stock is issued beyond this amount it is void, because the charter does not give the corporation permission to issue stock beyond the authorized amount. Very frequently companies ask for the authorization of a larger issue than they expect to put out at the present time. Consequently, the term "unissued stock" arises which represents stock which the company is authorized to issue when it choses to do so. It in no way represents an asset, but merely puts the company in position to issue more stock without changing its charter.

WAYS OF VALUING STOCK

Market Value.

The price at which stock is sold in the open market is known as its "market value." This value will be influenced by the general condition of the company, its earning power, credit, etc., and the condition of the stock market at that time.

Book Value.

The books of a corporation determine its book value. In other words, to ascertain this value, in a company having only common stock, the book value may be obtained by dividing the net worth by the number of shares outstanding. If preferred stock has been issued also, its book value is its right per share of the assets in the case of liquidation plus any accumulated dividends. The common stock book value is then found by dividing the remaining net worth by the number of common shares issued.

Real Value.

Real value in the final analysis is determined by market value under normal conditions. In some cases, the real value and the book value may be the same, provided the statements on the books reflect a true condition of the business.

Par Value.

Par value of stock, or what is sometimes known as face value, is the amount stated on the stock certificate. Most states permit the issuance of stock of any par value desired.

No Par Value.

Sometimes, shares of stock are issued at what is known as "no par value." Stock issued having par value expresses, theoretically at least, the amount of the stockholders original investment. In many cases the par value is very far from the real value, and, since such shares represents a certain proportion of the net worth of the enterprise, many corporations have recently adopted "no par value" stock.

From an accounting standpoint no par stock may be carried on the books in several ways. Thus various corporations will carry no par stock at the issue price, at a nominal figure, at the market price, at its book value, or at some arbitrarily fixed price.

Effect of the Type of Organization upon the Balance Sheet.

To show how the change of the type of organization affects the balance sheet a study may be made of the following forms of the balance sheet of a single proprietorship, a partnership, and a corporation, assuming the same business in each case.

J. R. Burton
Balance Sheet
Dec. 31, 19—

Total Assets	$160,000	Total Liabilities	$ 60,000
		Capital:	
		J. R. Burton, Investment	100,000
		Total Liabilities and	
Total Assets	$160,000	Capital	$160,000

Burton and Maxwell
Balance Sheet
Dec. 31, 19—

Total Assets	$160,000	Total Liabilities		$ 60,000
		Capital:		
		J. R. Burton, Investment	$ 50,000	
		W. B. Maxwell, Investment	50,000	
		Total		$100,000
		Total Liabilities and		
Total Assets	$160,000	Capital		$160,000

BURTON, MAXWELL, AND COMPANY
Balance Sheet
Dec. 31, 19—

Total Assets	$160,000	Total Liabilities	$ 60,000
		Capital:	
		Capital Stock	100,000
		Total Liabilities and	
Total Assets	$160,000	Capital	$160,000

Important Points of Difference.

1. The only differences in the balance sheets are in the name of the business and in the form of stating the capital.

2. The words "capital stock," are used to include all the owners in a corporation. The Capital Stock Account is a controlling account for the Capital Stock Ledger, in which are listed in detail the various stockholders' shares.

Necessity of a Surplus Account.

In a corporation it is sometimes desirable to leave some of the profits in the business. These profits are not added to the capital which each owner invested, but are put in an account known as a "Surplus Account." The capital of a corporation is the excess of assets over liabilities.

Total Permanent Capital, or Proprietorship, − Capital Stock = Surplus.

The law requires that each corporation carry on its books a "Capital Stock account" and a "Surplus Account."

On the Balance Sheet of a partnership it is necessary that each partner's capital investment be shown. In a corporation, the investments of the various owners are not shown. As explained previously the permanent capital, or proprietorship, of a corporation is shown under the two accounts, "Capital Stock" and "Surplus." Under neither one of these accounts are the individual investments shown. This is the chief difference between the corporation Balance Sheet and the partnership Balance Sheet.

Books of Corporate Record.

As has been shown, the general books of a corporation differ very slightly from those of the sole proprietorship or partnership engaged in a similar type of business. There is, however,

another set of books, auxiliary in nature, peculiar to the corporation itself. They most usually include:[1]

1. Minute Book.
2. Subscription record.
3. Installment receipts.
4. Installment Book.
5. Stock Certificate Book.
6. Stock Transfer Book.
7. Stock Ledger.
8. Dividend Book.
9. Bond Register.

The list will be expanded in the case of a large company and materially reduced in the case of the smaller ones where the stock is held by a few people.

These books are subordinate to the general books and are not used as posting mediums.

Partnership Problems.

There are certain representative problems which arise in connection with partnership accounting. A fundamental knowledge of such cases may be obtained by viewing them diagrammatically in T accounts.

Problem 1. Partnership Organization.

R. D. James and J. L. Fountain form a partnership. James is to contribute $20,000 in cash and Fountain, $25,000. Without giving the partnership agreement or the opening journal entries show the entries in the diagrammatic ledger.

Solution to Problem 1.

Assets	=	Liabilities	+	Capital	
				Permanent	Temporary
Cash				R. D. James	
$20,000				$20,000	
25,000					
				J. L. Fountain	
				$25,000	

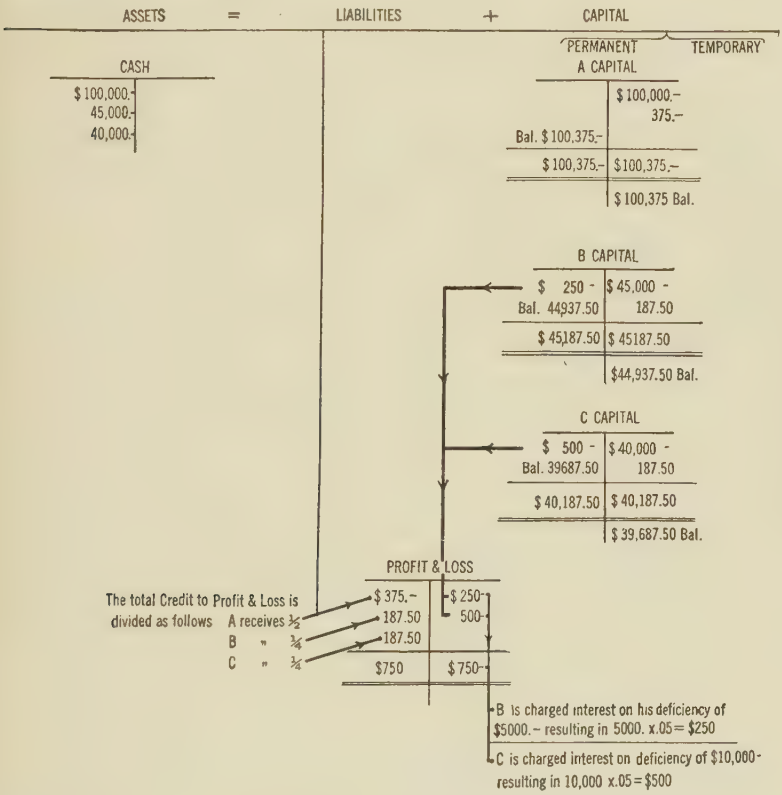
Problem 2. Partnership Organization—When Interest Is Charged.

In partnership organization, it is sometimes made a part of the agreement that interest shall be allowed on the amount of capital contributed by each partner at the beginning of the period. In some cases, it is credited on the excess above an agreed amount or charged on the deficiency below this amount. The following problem illustrates this principle.

[1] Bennett, "Corporation Accounting," p. 46.

A, *B*, and *C* agree to start in business with a capital of $200,000 of which *A* is to furnish $100,000, and *B* and *C* $50,000 each. *A* is to have one-half interest in the business and *B* and *C* each one-fourth. Interest at 5% is to be credited on excess or charged on deficiency of capital. *A* contributes $100,000, *B* $45,000, and *C* $40,000. How would the capital accounts stand on the books after adjusting the interest at the end of the year?[1]

Solution to Problem 2.



Solution to Problem 2.

Distribution of Profits.

After the organization of the partnership, the next biggest problem arising is the distribution of profits. Some of the most usual ways of distributing profits are (1) to divide them equally, (2) according to certain fixed ratios, (3) making allowance for interest on capital at the beginning of the period and dividing the balance according to fixed ratios, etc. Unless stated otherwise in the agreement, profits are divided equally.

Methods 1 and 2 are simple. Method 3 is a bit more complicated so an illustration of its procedure will be given in Problem 3 on page 172:

[1] New York C. P. A. Examination.

Problem 3.

Distribution of profits in a partnership by this method means making allowance for interest on capital at the beginning of the period and dividing the balance according to fixed ratios.

The following stated amounts were invested by three partners:

	Investments	Share of Profits after Deducting Interest on Investment
D. B. Thompson	$30,000	20%
J. R. Martin	40,000	50%
C. D. Charles	90,000	30%

It was agreed that profits should be distributed by allowing interests on original investments at 5%, the balance to be shared according to the following ratios, Thompson, 20%, Martin, 50%, Charles, 30% for reasons agreeable to all three. The profit for the period was $50,000.

Solution to Problem 3.

Arithmetically we may arrive at the distribution as follows:

Profit		$50,000
Interest on Thompson's Capital Investment	$30,000 × .05 =	$1,500
Interest on Martin's Capital Investment	$40,000 × .05 =	2,000
Interest on Charles' Capital Investment	$90,000 × .05 =	4,500
		8,000
		$42,000

The partners would then share as follows:

Thompson	$42,000 × .20 =	$ 8,400
Martin	$42,000 × .50 =	21,000
Charles	$42,000 × .30 =	12,600
		$42,000

On the diagrammatic ledger the entries would show as follows:

Assets = Liabilities + Capital

Cash		Permanent	Temporary
		D. B. Thompson, Capital	
$30,000		$30,000 Investment	
40,000			1,500 Interest on Investment
90,000			8,400 Share of Profit
		J. R. Martin, Capital	
		$40,000 Investment	
			2,000 Interest on Investment
			21,000 Share of Profit
		C. D. Charles, Capital	
		$90,000 Investment	
			4,500 Interest on Investment
			12,600 Share of Profit

Profit and Loss

	$.....	$.....
	.....	.....
	.....	.....
	Net Profit $50,000	
	$.....	$.....
Interest on Investment	$ 8,000	$50,000 Net Profit
Distribution	42,000	
	$50,000	$50,000

Admission of New Partners.

When new partners are admitted to the business, certain complications arise. The consent of the old partners must be obtained and their accounts adjusted because of the goodwill value placed on most going concerns.

Problem 4.

M. A. Shelby and D. L. Sommers decide to take R. B. Mason into their business, crediting his Capital account for the exact amount of his investment, $10,000. It is agreed among the three that the goodwill of the business shall be valued at $20,000 which will be credited to the accounts of the old partners.

Solution to Problem 4.

Assets = Liabilities + Capital

Capital: Permanent | Temporary

Cash		M. A. Shelby, Capital	
(1) $10,000			$10,000 (2)

Goodwill		D. L. Sommers, Capital	
(2) $20,000			$10,000 (2)

		R. B. Mason, Capital	
			$10,000 (1)

Partnership Dissolution.

While there are many other angles involved in the operation of partnership, a detailed study of them is beyond the scope of this work.

One important phase of this work remains, however, in the problems arising in the dissolution of partnership.

To illustrate this type of partnership transaction the following problem is given:

Problem 5.

A, B, and C engage in business, A contributing $10,000, and B $5,000, while C, in lieu of any capital contribution, agrees to undertake the active management at a salary of $3,000 per year, to be paid monthly.

After allowing 5% interest on capital, they are to divide the net result in the proportion 5, 3, and 2, respectively.

At the end of 18 months, they ascertain the position to be unfavorable and decide to wind up. The assets realize $12,500 cash; there are no liabilities except for capital and interest thereon and 1 month's salary due C.

Make up the partners' accounts, showing the amount to be received by each.[1]

[1] Massachusetts C. P. A. Examination.

SOLUTION

Profit and Loss

1 Loss on Realization...	$ 2,750.00	A ½ net loss.....	$ 1,937.50
Interest on Capital.....	1,125.00	B 3/10 net loss.....	1,162.50
		C 2/10 net loss.....	775.00
	$ 3,875.00		$ 3,875.00

Interest on Capital

Interest on A's Capital	$ 750.00	Profit and Loss.....	$ 1,125.00
Interest on B's Capital	375.00		
	$ 1,125.00		$ 1,125.00

A—Capital

½ Net loss.....	$ 1,937.50	Investment.....	$10,000.00
Balance.....	8,812.50	Interest.....	750.00
	$10,750.00		$10,750.00
		Balance.....	$ 8,812.50

B—Capital

3/10 Net loss.....	$ 1,162.50	Investment.....	$ 5,000.00
Balance.....	4,212.50	Interest.....	375.00
	$ 5,375.00		$ 5,375.00
		Balance.....	$ 4,212.50

C—Salary Account

2/10 Net loss.....	$ 775.00	Salary Due.....	$ 250.00
		Balance.....	525.00
	$ 775.00		$ 775.00
Balance.....	$ 525.00		

Loss on Operation.....	$15,000 − $12,500 = $2,500
C's Salary.....	250
1 Total.....	$2,750

Corporations Problems.

Many distinctive features arise in connection with the accounting for corporations.

While it is not the purpose of this chapter to go into the details of corporation accounting, a study of a series of problems illustrating the major principles involved will be helpful.

The first problem will be in illustrating the opening entries of a corporation. Two general types arise here.

Two Types of Opening Entries.

The subscription of the stock and the payment may be simultaneous in which case the problem is simple as shown by the solution in Case 1.

In many cases, however, subscriptions are secured in advance of the actual payment of cash. To set up this fact upon the books two new accounts, a Subscribers' Account and a Capital Stock Subscription Account are used. These accounts are of a contingent or a temporary nature and are closed out as soon as cash is paid.

Problem 6.

The Paxton Axle Company is incorporated with an authorized capital stock issue of $500,000. $300,000 worth is subscribed and paid for at par. The expenses in organizing are $5,000.

Solve when in Case 1 the subscriptions and payment are simultaneous.

Solve when in Case 2 the subscriptions and payment are not simultaneous.

Prepare the regular journal entries and a diagrammatic ledger.

Solution to Problem 6—Case 1.

PAXTON AXLE COMPANY

Case 1. Where the subscription and payment are simultaneous.

(*a*)	Cash	$300,000	
	Capital Stock		$300,000
	To record the issue of stock to all subscribers in payment of cash		
(*b*)	Organization Expense	$ 5,000	
	Cash		$ 5,000
	To record the payment of the costs of organizing the corporation		

Assets = Liabilities + Capital					
Cash		Permanent		Temporary	
(a) $300,000	$5,000 (b)	Capital Stock		Income	Outgo
			$300,000 (a)	Organization Expense	
				(b) $5,000	

Book of Paxton Axle Co.

Solution to Problem 6—Case 2.

PAXTON AXLE COMPANY

Case 2. Where the subscription and payment are not simultaneous:

(a)	Subscribers	$300,000	
	Capital Stock Subscriptions		$300,000
	To Record the subscriptions to capital stock as follows		
	Details *A*—— ——— shares		
	B—— ——— shares		
	C—— ——— shares		
(b)	Cash	$300,000	
	Subscribers		$300,000
	To credit subscribers for the payment of their subscriptions		
(c)	Capital stock subscriptions	$300,000	
	Capital Stock		$300,000
	To record the issue of stock to all subscribers who have paid in full		
(d)	Organization Expense	$ 5,000	
	Cash		$ 5,000
	To record the payment of the costs of organizing the corporation.		

Assets = Liabilities + Capital

Subscribers

(a) $300,000	$300,000 (b)

Cash

(b) $300,000	$5,000 (d)

Capital — Permanent

Capital Stock

	$300,000 (c)

Capital — Temporary

Income

Capital Stock Subscriptions

(c) $300,000	$300,000 (a)

Outgo

Organ. Expenses

(d) $5,000	

Books of Paxton Axle Company

Solution to Problem 6 Case 2.

Changing from a Partnership to a Corporation.

When partners feel it would be advantageous to change to the corporate form of organization, a series of entries must be made to open the books of the new corporation and to close the books of the partnership.

Problem 7.

H. S. Campbell and B. A. Weston, partners, incorporate as the International Mercantile Company. Their authorized capitalization is $300,000. Each partner subscribes for an amount of stock equal to his interest in the partnership, and L. A. Snyder, an outsider, subscribes for the remainder of the stock at par value. The corporation purchases the assets and liabilities of the partnership, paying for it with stock as above. L. A. Snyder pays for his share in cash. The Balance Sheet of the partnership prior to its incorporation is as follows:

BALANCE SHEET
OF H. S. CAMPBELL AND B. A. WESTON
AS OF JAN. 31, 19—

Cash	$ 15,000	Accounts Payable	$ 25,000
Accounts Receivable	100,000	Mortgage Payable	52,000
Merchandise Inventory	75,000	H. S. Campbell, Capital	150,000
Furniture and Fixtures	25,000	B. A. Weston, Capital	75,000
Building	87,000		
	$302,000		$302,000

Make the opening entries in the journal and diagrammatic ledger for opening the books of the corporation, and the same entries for closing the books of the partnership.

Solution to Problem 7.

1. Entries to Open the Corporation's Books.

INTERNATIONAL MERCANTILE COMPANY

(*a*)	Subscribers		$300,000	
	Capital Stock Subscriptions			$300,000
	To record subscriptions to capital stock as follows:			
	H. S. Campbell	$150,000		
	B. A. Weston	75,000		
	L. A. Snyder	75,000		
(*b*)	Cash		$ 15,000	
	Accounts Receivable		100,000	
	Merchandise		75,000	
	Furniture and Fixtures		25,000	
	Plant (buildings)		87,000	
	H. S. Campbell and B. A. Weston, Vendors			$302,000
	To record the purchase from H. S. Campbell and B. A. Weston the partnership assets			

INTERNATIONAL MERCANTILE COMPANY.—(*Continued*)

(*c*)	H. S. Campbell and B. A. Weston, Vendors	$ 77,000	
	Accounts Payable		$ 25,000
	Mortgages Payable		52,000
	To record partial payment to H. S. Campbell and B. A. Weston for their assets by the assumption of their liabilities		
(*d*)	H. S. Campbell and B. A. Weston, Vendors	$225,000	
	Subscribers		$225,000
	To record full payment to H. S. Campbell and B. A. Weston for balance due them by the cancellation of their subscription indebtedness		
(*e*)	Cash	$ 75,000	
	Subscribers		$ 75,000
	To record payment by L. A. Snyder of his subscription contract		
(*f*)	Capital Stock subscriptions	$300,000	
	Capital Stock		$300,000
	To record the issue of stock to all subscribers who have paid in full.		

Assets = Liabilities + Capital

Capital: Permanent | Temporary

Subscribers

(a)	$300,000	$225,000	(d)
		75,000	(e)
	$300,000	$300,000	

Cash

(b)	$15,000		
(e)	75,000		

Accounts Receivable

(b)	$100,000		

Merchandise

(b)	$ 75,000		

Furniture and Fixtures

(b)	$ 25,000		

Buildings

(b)	$ 87,000		

Accounts Payable

		$25,000	(c)

Mortgage Payable

		$52,000	(c)

H. S. Campbell and B. A. Weston, Vendors

(c)	$ 77,000	$302,000	(b)
(d)	225,000		
	$302,000	$302,000	

Capital Stock

		$300,000	(f)

Income and Outgo

Capital Stock Subscriptions

(f)	$300,000	$300,000	(a)
	$300,000	$300,000	

Books of International Mercantile Company

Entries to open books of corporation.
Solution to Problem 7.

2. The entries to close the books of partnership of H. S. Campbell and B. A. Weston are:

(*a*)	International Mercantile Company	$302,000	
	Cash		$ 15,000
	Accounts Received		100,000
	Merchandise		75,000
	Furniture and Fixtures		25,000
	Plant (buildings)		87,000
	To charge the International Mercantile Company with the assets purchased under contract of Jan. 31, 1927.		
(*b*)	Accounts Payable	$ 25,000	
	Mortgage Payable	52,000	
	International Mercantile Company		$ 77,000
	To credit the International Mercantile Company under their purchase contract for the taking over of the firm's Liabilities.		
(*c*)	International Mercantile Company Stock	$225,000	
	International Mercantile Company		$225,000
	To credit the International Mercantile Company for the payment of the balance due by the issue of its stock at par to the firm.		
(*d*)	H. S. Campbell, Capital	$150,000	
	B. A. Weston, Capital	75,000	
	International Mercantile Company Stock		$225,000
	To show the distribution of the stock.		

Assets

Plant (Buildings)

$ 87,000	$ 87,000 (*a*)
$ 87,000	$ 87,000

Cash

$ 15,000	$ 15,000 (*a*)
$ 15,000	$ 15,000

Liabilities

Accounts Payable

(*b*) $ 25,000	$ 25,000
$ 25,000	$ 25,000

Capital

Permanent

H. S. Campbell

(*d*) $150,000	$150,000
$150,000	$150,000

B. A. Weston

(*d*) $ 75,000	$ 75,000
$ 75,000	$ 75,000

Temporary

Income

Outgo

International Mercantile Company

(*a*) $302,000	$ 77,000 (*b*) 225,000 (*c*)
$302,000	$302,000

Accounts Receivable

$100,000	$100,000 (*a*)
$100,000	$100,000

Mortgage Payable

(*b*) $52,000	$ 52,000
$52,000	$ 52,000

Merchandise

$ 75,000	$ 75,000 (*a*)
$ 75,000	$ 75,000

International Mercantile Company Stock

(*c*) $225,000	$225,000 (*d*)
$225,000	$225,000

Furniture and Fixtures

$ 25,000	$ 25,000 (*a*)
$ 25,000	$ 25,000

Books of Partnership
H. S. Campbell and
B. A. Weston

Entries to close books of partnership.
Solution to Problem 7.

Typical Problems of Incorporation.

Many intricate problems of finance arise in connection with problems of incorporation. The following problem is representative of what might be expected in the promotion and formation of an average industry.

Problem 8.

The Williams Broach Company is organizing under the laws of the State of New York to form a manufacturing business. The authorized capital stock is $750,000—divided into $500,000 common stock, and $250,000 preferred stock, par value $100. Ten incorporators each subscribe for 100 shares of common stock at face value. James Mason, one of these incorporators, purchased the complete plants of two manufacturing companies for $650,000 and transfers said plants to the Williams Broach Company for the remaining $650,000 of common and preferred stock, and $85,000 of first mortgage, 4% bonds out of a total issue of $100,000. The incorporators then pay in cash for their respective subscriptions.

The individual assets acquired are as follows: Land and Buildings, $95,000; Plant and Machinery $225,000; Tools, Equipment, etc., $75,000; Inventories, $125,000; Cash $30,000; Accounts Receivable, $60,000; Doubtful Accounts Receivable, $15,000; U. S. Bonds, $30,000.

Prepare (*a*) the opening entries for the journal of the Williams Broach Company, (*b*) the diagrammatic ledger, (*c*) the initial balance sheet of the company.

Solution to Problem 8.

WILLIAMS BROACH COMPANY

The Williams Broach Company, a corporation incorporated under the laws of New York, with an authorized capital stock of $250,000 preferred stock, and $500,000 common stock, shares being of par value $100 each.

(*a*)	Subscribers to Common Stock	$100,000	
	Common Stock Subscriptions		$100,000
	To record subscription to 100 shares of common stock by each of the 10 incorporators.		
(*b*)	Plant, Goodwill, and Sundry Assets	$735,000	
	James Mason, Vendor		$735,000
	To record purchase of certain assets per contract sale on file as under		
	Preferred Stock $250,000		
	Common Stock 400,000		
	Mortgage Bonds 85,000		
	$735,000		
(*c*)	James Mason, Vendor	$735,000	
	Preferred Stock		$250,000
	Common Stock		400,000
	First Mortgage 4% Bonds		85,000
	To record full payment for assets acquired from James Mason.		
(*d*)	Cash	$100,000	
	Subscribers to Common Stock		$100,000
	To record payment of subscriptions.		
(*e*)	Common Stock subscription	$100,000	
	Common stock		100,000
	To record issue of each share of stock paid by cash.		
(*f*)	Land and Buildings	$ 95,000	
	Plant and Machinery	225,000	
	Tools, Equipment and Fixtures	75,000	
	Inventories	125,000	
	Accounts Receivable	75,000	
	Cash	30,000	
	Bonds (U. S.)	30,000	
	Goodwill	95,000	
	Reserve for Bad and Doubtful Accounts		$ 15,000
	Plant, Goodwill and Sundry Assets		735,000
	To place upon the records the various assets acquired in accordance with decision of the directors, a reserve is set to provide for the possible loss on doubtful accounts receivable.		

Assets = Liabilities + Capital

Capital: Permanent; Temporary (Income, Outgo)

Subscribers to Common Stock

(a)	$100,000	(d)	$100,000
	$100,000		$100,000

James Mason, Vendor

(c)	$735,000	(b)	$735,000
	$735,000		$735,000

Preferred Stock

	(c) $250,000

Common Stock

	(c) $400,000
	(e) 100,000

Income Common Stock

(e)	$100,000	(a)	$100,000
	$100,000		$100,000

Outgo Subscriptions

Plant, Goodwill and Sundry Assets

(b)	$735,000	(f)	$735,000
	$735,000		$735,000

First Mortgage Bonds

	(c) $85,000

Cash

(d)	$100,000
(f)	30,000

Land and Buildings

(f)	$ 95,000

Plant and Machinery

(f)	$225,000

Accounts Receivable

(f)	$ 75,000

Reserve for Accounts Receivable

	(f) $ 15,000

Tools, Equipment and Fixtures

(f)	$ 75,000

U. S. Bonds

(f)	$ 30,000

Inventories

(f)	$125,000

Goodwill

(f)	$ 95,000

Books of the Williams Broach Company

Solution to Problem 8.

THE WILLIAMS BROACH COMPANY
Balance Sheet
Jan. 1, 19—

Assets

Cash		$ 130,000
Bonds		30,000
Accounts Receivable	$ 75,000	
Less, Reserve	15,000	60,000
Inventories		125,000
Land and Buildings		95,000
Plant and Machinery		225,000
Tools, Equipment and Fixtures		75,000
Goodwill		95,000
		$835,000

Liabilities

First Mortgage 4% Bonds ($100,000 authorized)		$ 85,000
Capital stock (authorized and outstanding)		
Preferred	$250,000	
Common	500,000	750,000
		$835,000

Under certain conditions a corporation is formed by the reorganizing and taking over one or more going concerns. This procedure brings to light many interesting problems of finance and accounting.

Problem 9.

Corporation C is organized in New York with an authorized capital stock of $500,000 divided equally between preferred and common, the shares being of the par value of $100 each. Sufficient shares of common stock are subscribed and paid in cash to effect the incorporation, and a contract is entered into for the taking over of the business of Corporation A and of Corporation B, the balance sheets of which, at the time of the transfer, displayed financial condition as follows: (New York C. P. A. Examination.)

CORPORATION A

Assets		Liabilities	
Plant and Machinery	$ 35,000	Common Stock	$ 50,000
Raw Materials	6,500	Preferred Stock	42,500
Work in Process	9,200	Preferred Stock Scrip	7,500
Finished Product	16,700	Surplus	5,400
Accounts Receivable	33,500	Accounts Payable	14,200
Notes Receivable	14,500		
Deferred Charges	1,200		
Cash	3,000		
	$119,600		$119,600

CORPORATION B

Assets		Liabilities	
Plant and Machinery	$ 51,000	Capital Stock	$100,000
Inventories	32,000	Accounts Payable	31,610
Accounts Receivable	47,500	Reserve for Bad Debts	1,940
Cash	1,000		
Deficit	2,050		
	$133,550		$133,550

The contract provides, in settlement for the properties and business acquired, *that preferred stock be issued in each case to the extent of the excess of the asset values*, as stated, over the liabilities, and *that an equal amount of common stock be issued in payment of the goodwill.*

Draft opening entries of Corporation C, and prepare balance sheet.

This problem may be difficult of solution unless the reader follows that part of the contract carefully in which it is stated "that preferred stock be issued in each case to the extent of the excess of the asset values, as stated, over the liabilities, and that an *equal amount of common stock be issued in payment of the goodwill.*"

Thus the value for the entry

Corporation A, Vendor		$210,800	
is obtained as follows:			
Total Asset, Corporation A	$119,600		
(less) Total Liabilities Corporation A	14,200		
	$105,400		Preferred Stock
(plus an equal amount of) Common Stock	105,400		Common Stock
	$210,800		

and the corresponding value for

Corporation B, Vendor		$195,900	
is obtained in a similar manner:			
Total Assets	$133,550		
less Accounts Payable	$31,610		
Reserve for Bad Debts	1,940		
Deficit	2,050		
	35,600		
	$ 97,950		Preferred Stock
(plus an equal amount of) Common Stock	97,950		Common Stock
	$195,900		

Solution to Problem 9.

Cash	$ 500	
Common Stock		$ 500
Issue of five shares of common stock for cash.		

Cash	$ 3,000	
Plant and Sundry Assets	222,000	
Accounts Payable		$ 14,200
Corporation A, Vendor		210,800

Purchase of plant and assets of Corporation A in accordance with contract approved by board of directors.

Corporation A, Vendor	$210,800	
Preferred Stock		$105,400
Common Stock		105,400

Payment of balance due Corporation A.

Cash	$ 1,000	
Plant and Sundry Assets	228,450	
Accounts Payable		$ 31,610
Reserve for Bad Debts		1,940
Corporation B, Vendor		195,900

Purchase of plant and assets of Corporation B in accordance with contract approved by board of directors.

Corporation B, Vendor	$195,900	
Preferred Stock		$ 97,950
Common Stock		97,950

Payment of balance due Corporation B.

Plant and Machinery	$ 86,000	
Raw Material	6,500	
Work in Process	9,200	
Finished Product	16,700	
Inventories (B)	32,000	
Accounts Receivable (per schedule)	81,000	
Notes Receivable	14,500	
Deferred Charges	1,200	
Goodwill	203,350	
Plant and Sundry Assets		$450,450

To set up valuation of assets made by board of directors.

CORPORATION C
Balance Sheet
Assets

Capital Assets:		
Goodwill	$203,350	
Plant and Machinery	86,000	
Total		$289,350

BALANCE SHEET OF CORPORATION C.—(*Continued*)

Current Assets:			
Inventories		$ 64,400	
Accounts Receivable	$81,000		
Less reserve for Bad Debts	1,940	79,060	
Notes Receivable		14,500	
Cash		4,500	
Total			$162,460
Deferred Charges			1,200
Total			$453,010

Liabilities and Capital

Capital Stock:			
Preferred Stock		$203,350	
Common Stock		203,850	
Total			$407,200
Current Liabilities:			
Accounts Payable			45,810
Total			$453,010

Treasury Stock Donated.

After the formation of a corporation it is often desirable to raise more cash. Where stock has been issued as fully paid to one or more of the incorporators, it is frequently donated back to the treasury to be sold at a discount. In this manner the legal and liability features are side stepped, in that the stock was originally issued as fully paid.

Problem 10.

A corporation is organized with a capital stock of $300,000—par value of shares $100—to acquire a business formerly conducted by Charles Allen. The business has assets of $350,000 and sundry liabilities of $125,000. Fifty shares of stock each are sold at par to Herbert Rogers, Edward Gillett, and John Bool who afterwards become directors of the new corporation. The remaining stock is issued to Charles Allen who immediately donates $20,000 of stock to the treasury to procure additional capital. A month later $5,000 of the donated stock is sold at 35, and a year later the remainder is sold at 55.

Set up the necessary journal entries, and make a diagrammatic ledger.

Solution to Problem 10.

TREASURY STOCK

(*a*)	Cash	$ 15,000	
	Capital Stock		$ 15,000
	To record the sale for cash of 50 shares of stock each to Herbert Rogers, Edward Gillett, and John Bool.		

TREASURY STOCK.—(*Continued*)

(*b*)	Sundry Assets	$350,000	
	Charles Allen, Vendor		$350,000
	To record the assets acquired from Charles Allen.		
(*c*)	Charles Allen, Vendor	$125,000	
	Sundry Liabilities		$125,000
	To record the liabilities assumed.		
(*d*)	Charles Allen, Vendor	$225,000	
	Goodwill	60,000	
	Capital Stock		$285,000
	To show the issue to Charles Allen of the entire capital stock of the company with the exception of the 150 shares sold for cash. As the amount of stock issued to Allen is $60,000 in excess of the net worth of the property acquired by him, the excess represents the valuation expressed in stock which was placed upon the goodwill of the business acquired from him.		
(*e*)	Treasury stock	$20,000	
	Treasury stock Donated		$20,000
	To record the donation of 200 shares of stock to the corporation by Allen to be sold to procure additional capital.		
(*f*)	Cash	$ 1,750	
	Treasury stock		$ 1,750
	To record the sale of 50 shares of treasury stock at 35.		
(*g*)	Cash	$ 8,250	
	Treasury stock		$ 8,250
	To record the sale of the remaining 150 shares of treasury stock at 55.		
(*h*)	Treasury Stock Donated	$10,000	
	Treasury Stock		$10,000
	To close the treasury stock account.		
(*i*)	Treasury stock Donated	$10,000	
	Surplus		$10,000
	To record the surplus secured through the donation of treasury stock.		

Assets = Liabilities + Capital

Cash

(a) $15,000	
(f) 1,750	
(g) 8,250	

Sundry Assets

(b) $350,000	

Goodwill

(d) $60,000	

Treasury Stock

(e) $20,000	(f) $ 1,750
	(g) 8,250
	(h) 10,000
$20,000	$20,000

Charles Allen, Vendor

(c) $125,000	(b) $350,000
(d) 225,000	
$350,000	$350,000

Sundry Liabilities

	(c) $125,000

Capital

Permanent

Capital Stock

	(a) $ 15,000
	(d) 285,000

Surplus

	(i) $10,000

Temporary

Income Treasury Stock

(h) $10,000	
(i) 10,000	
$20,000	$20,000

Outgo Donated

(e) $20,000	

Solution to Problem 10.

FURTHER CORPORATE PROBLEMS

(Book value of stock, stock authorized and unissued, declaration and payment of dividend)

Problem 11.

The Weir Furniture Company has authorized capital stock of $500,000 divided into 5,000 shares with a par value of $100 each, of which $375,000 has been issued (3,750 shares outstanding). If the company has a surplus of $75,000, what is the book value of each share of stock?

Solution to Problem 11.

$375,000 + $75,000 = $450,000, Total Capital
$450,000 ÷ 3,750 = $120 per share

Problem 12.

The Rex-Meyers Company is authorized to have a capital stock of $300,000; owners have invested only $225,000. The surplus of the corporation is $48,290. Show the net worth section of its balance sheet.

Solution to Problem 12.

Capital:			
Capital Stock Authorized	$300,000		
Less Amount Unissued	75,000		
Capital Stock Issued		$225,000	
Surplus		48,290	
Total Capital			$273,290

Problem 13.

The Blue Stock Printing Company has capital stock of $200,000. Jan. 1, 19—, profits amounting to $56,283.50 were left in the business. The profits for the year, 19—, were $15,575.90. A 10% dividend was declared. Show in detail the net worth section of the balance sheet.

Solution to Problem 13.

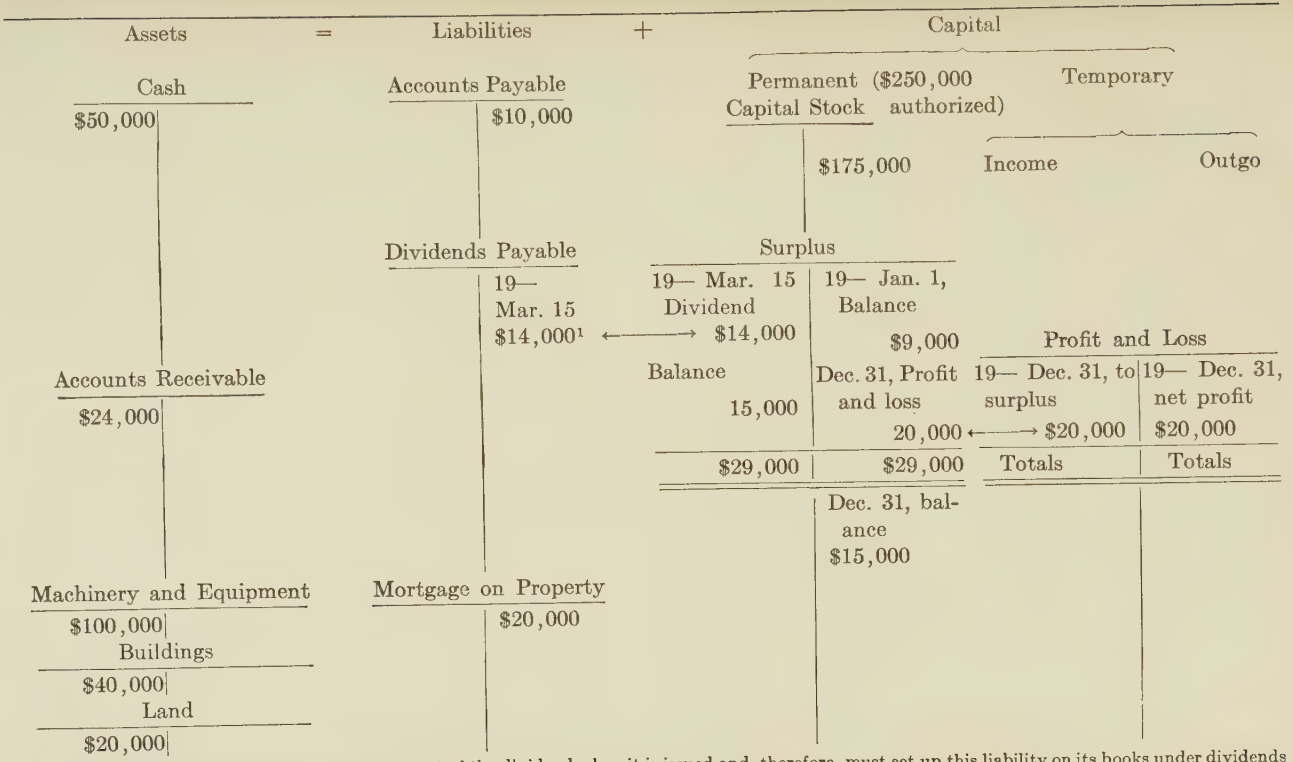
Net Worth		
Capital Stock		$200,000.00
Surplus, Jan. 1, 19—	$56,283.50	
Net Profits for Year	15,575.90	
	$71,859.40	
Dividends Declared	20,000.00	
Dec. 31, 19—		51,859.40
Total Net Worth		$251,859.40

Problem 14.

The National Drill Company has an authorized capital stock of $250,000 of which $75,000 has not been issued. The company has been in operation for some years and has accumulated a surplus balance at the beginning of the year amounting to $9,000. At the end of its present fiscal year, Dec. 31, 19—, its net profits were $20,000. The company declared a dividend of 8%, payable Mar. 15. The assets were Cash, $50,000; Accounts Receivable, $24,000; Buildings, $40,000; Land, $20,000; Machinery and Equipment, $100,000, and the liabilities before declaring dividends were Accounts Payable $10,000; Mortgage on property $20,000.

a. Set up the ledger accounts needed to record the above information.

b. Draw up the balance sheet for the end of the present fiscal year.



[1] The company becomes liable for the payment of the dividend when it is issued and, therefore, must set up this liability on its books under dividends payable. The debit is the surplus. When the dividend is paid, Cash is credited and Dividends payable debited.

Solution to Problem 14(a).

NATIONAL DRILL COMPANY
Balance Sheet, Dec. 31, 19—

Assets			Liabilities and Net Worth			
Current Assets			Current Liabilities			
Cash	$ 50,000		Account Payable		$ 10,000	
Accounts Receivable	24,000		Dividends Payable		14,000	
Total Current Assets	$ 74,000	$ 74,000	Total Current Liabilities		$ 24,000	$ 24,000
Fixed Assets			Fixed Liabilities			
Machinery and Equipment	$100,000		Mortgage on Property		$ 20,000	$ 20,000
Buildings	40,000		Net Worth:			
Land	20,000		Capital Stock:			
Total Fixed Assets	$160,000	$160,000	Authorized	$250,000		
			Less Unissued	75,000		
			Issued	$175,000	$175,000	
			Surplus:			
			Balance of Jan. 1, 19—	$ 9,000		
			Net Profit Dec. 31, 19—	20,000		
				$ 29,000		
			Dividends Payable	14,000		
			Balance Dec. 31, 19—	$ 15,000	$ 15,000	
			Total Net Worth		$190,000	$190,000
Total Assets		$234,000	Total Liabilities and Net Worth			$234,000

Solution to Problem 14(b).

SUMMARY

In Chap. XII the following accounts were emphasized:

1. Partnership and corporation forms of organization require merely an extension of the proprietorship function.
2. Corporate accounts are required by law to carry a Surplus Account and may not add net profits directly to capital as was the case in the single and partnership forms.
3. The usual types of partnership problems are:
   - *a.* Partnership organization (either with or without the charge of interest).
   - *b.* Distribution of profits.
   - *c.* Admission of new partners.
   - *d.* Partnership dissolution.
4. Corporate problems are:
   - *a.* Changing from a partnership to a corporation.
   - *b.* Various problems of corporate financing.
   - *c.* Treasury stock problems.
   - *d.* Problems involving the declaration of dividends.

REFERENCES FOR PART I

(Chaps. I to XII, Inclusive)

Bennett, R. J., "Corporation Accounting."

Bliss, J. H., "Management Thru Accounts."

Castenholtz, W. B., "Cost Accounting Procedure."

Dewing, A. S., "Financial Policy of Corporations."

Gantt, H. L., "Work, Wages, and Profits."

Gerstenberg, C. W., "Financial Organization and Management."

Gilman, S., "Analyzing Financial Statements."

Harrison, G. C., "Cost Accounting to Aid Production"; "Installing Standard Costs": A series of articles in *Manufacturing Industries* beginning September, 1927, p. 193.

Himmelblau, D., "Complete Accounting Course."

Jordan and Harris, "Cost Accounting—Principles and Practice," 1925.

Kester, R. B., "Accounting Theory and Practice," Vol. I, 1920; Vol. I, 1922; Vol. II, 1922.

Kimball, D. S., "Principles of Industrial Organization," 1925.

Kohler and Morrison, "Principles of Accounting."

Koopman—Kester, "Fundamentals of Accounting."

Krebs, W. S., "Outlines of Accounting," Vol. I, Vol. II.

Lincoln, E. E., "Applied Business Finance."

National Electric Manufacturing Association, "Standard Accounting and Costs System for Electrical Industry."

Pace and Pace, "Theory and Practice of Accounts."

Paton, W. A., "Accounting."

Powelson, J. A., "Introductory Accounting."

Reed, H. L., "Corporation Finance."

Taylor, F. W., "Principles of Scientific Management."

Woodbridge, F. W., "Elements of Accounting"; "Solutions to Problems."

INTRODUCTION TO PART II

In Part I, Chaps. I to XII, inclusive, modern accounting principles and mechanisms were developed and discussed. It is the purpose of Part II, Chaps. XIII to XXI inclusive, to extend these principles to a manufacturing business.

To accomplish this purpose, a knowledge of certain fundamental industrial procedures is necessary, and before going further they will be briefly presented.

While the writer does not favor elaborate detail in such systems, actual conditions as found in industry must, however, be met. Historically, the following curve, suggested by Prof.

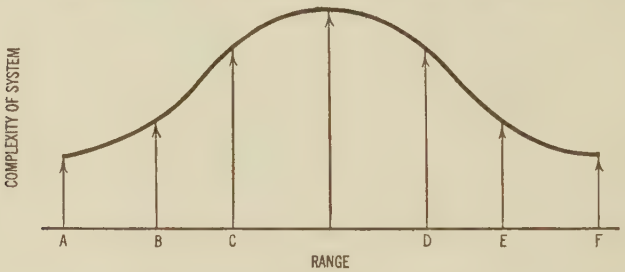


FIG. 29.

M. A. Lee of the Industrial Engineering Department, Cornell University, brings out the trend of such systems:

In the early days, systems were very simple and cost control very incomplete. The amount of detail was small, and most industries occupied the range *A-B*. As a desire for control grew, and the services of accountants and cost accountants came more into demand, more elaborate systems were devised and many industries occupied the range *C-D*. This increase of detail was also caused by the great variety of products manufactured by one concern. The trend today, however, is toward simpler schemes and many firms now, due to modern production methods, occupy the range *E-F*. Note the trend toward the continuous flow of product as brought about by the modern automobile assembly chain. Under such conditions, costs are very uniform and the so-called "spot cost method" which consists in checking

the cost of a car at certain intervals of time is used to a great extent.

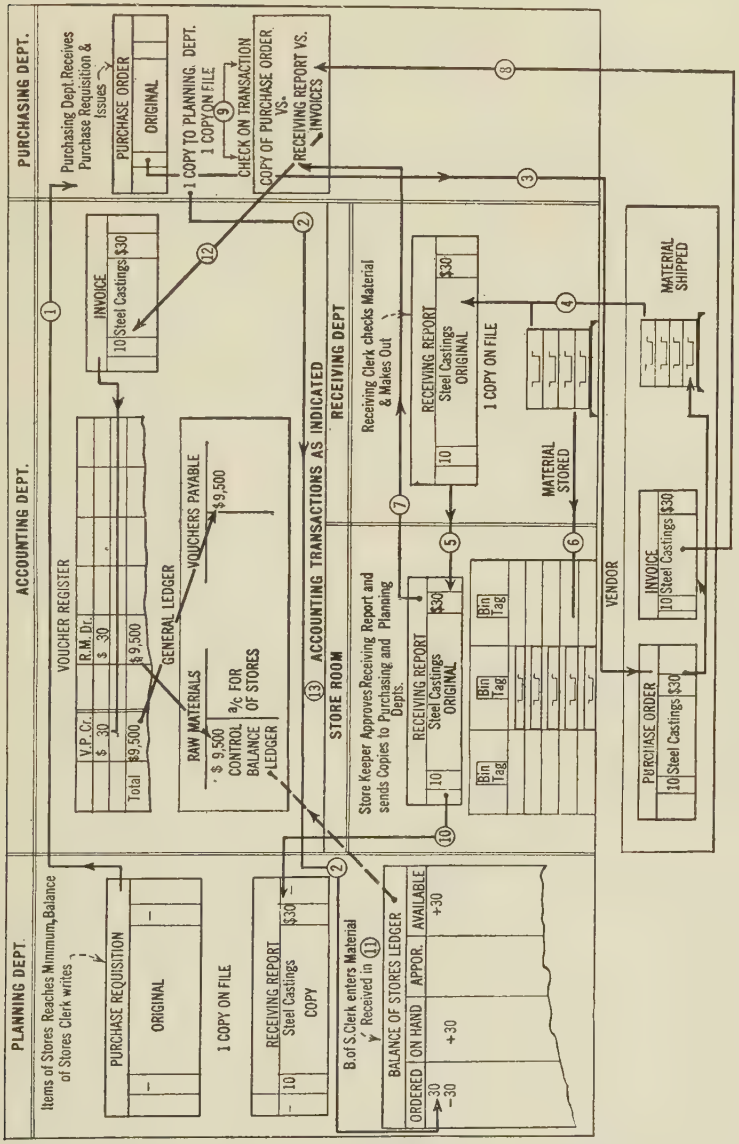


FIG. 30.—Procedure for purchasing and receiving raw materials.

Nevertheless, the systems of many of our large electrical manufacturing industries, machine tool industries, etc. are,

as a result of the tremendous variety of products, still quite complex. They fall within the *B-C* or *D-E* range. To meet

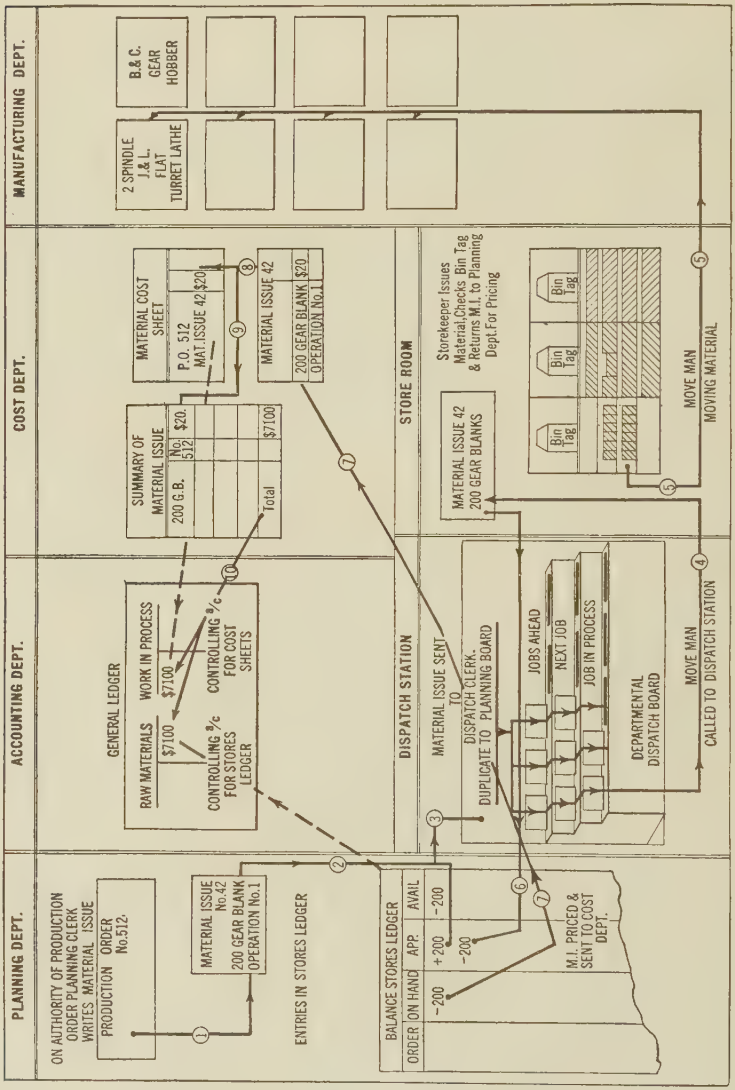


FIG. 31.—Procedure for issuing raw materials from stores.

such conditions, it is felt necessary that a knowledge of certain fundamental industrial procedure is necesssary and the following diagrams are presented with this purpose in mind.

These procedures are:

1. Procedure for Purchasing and Receiving Raw Materials.
2. Procedure for Issuing Raw Materials from Stores.

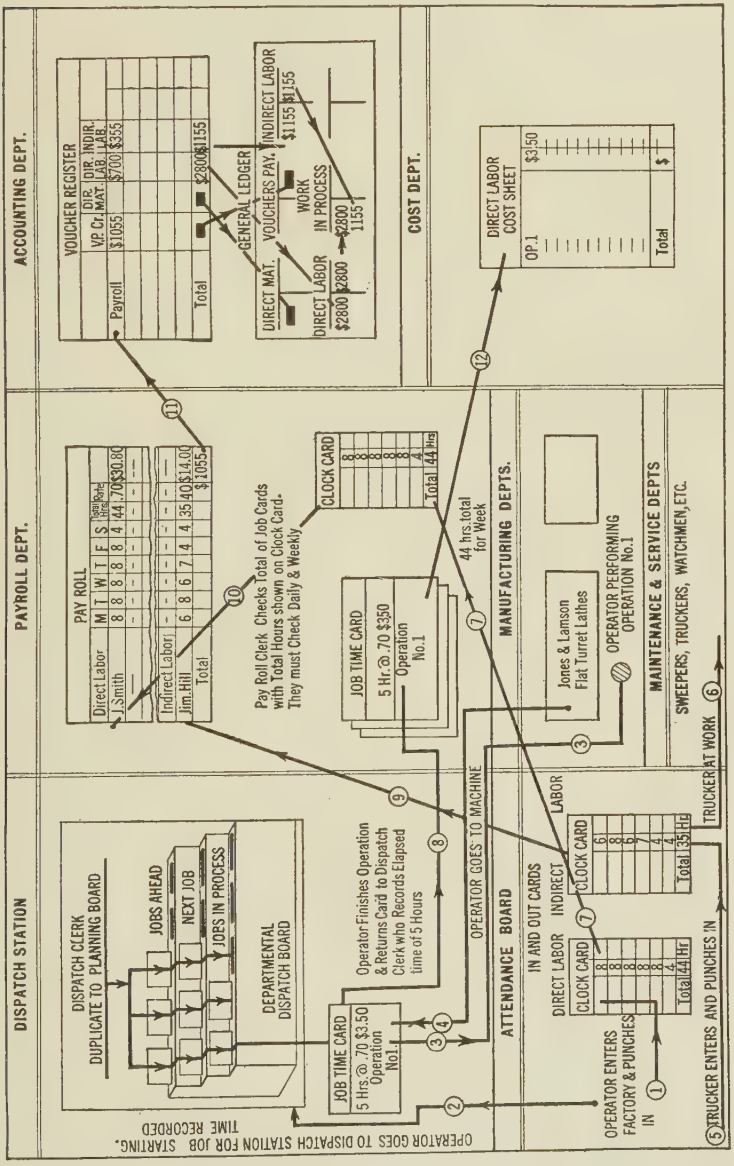


Fig. 32.—Procedure for handling direct and indirect labor.

3. Procedure for Handling Direct and Indirect Labor.
4. Procedure for Predetermining and Distributing Expense.

It is not the purpose to go into a detailed description of each procedure but it is hoped that the diagrams will be self-explana-

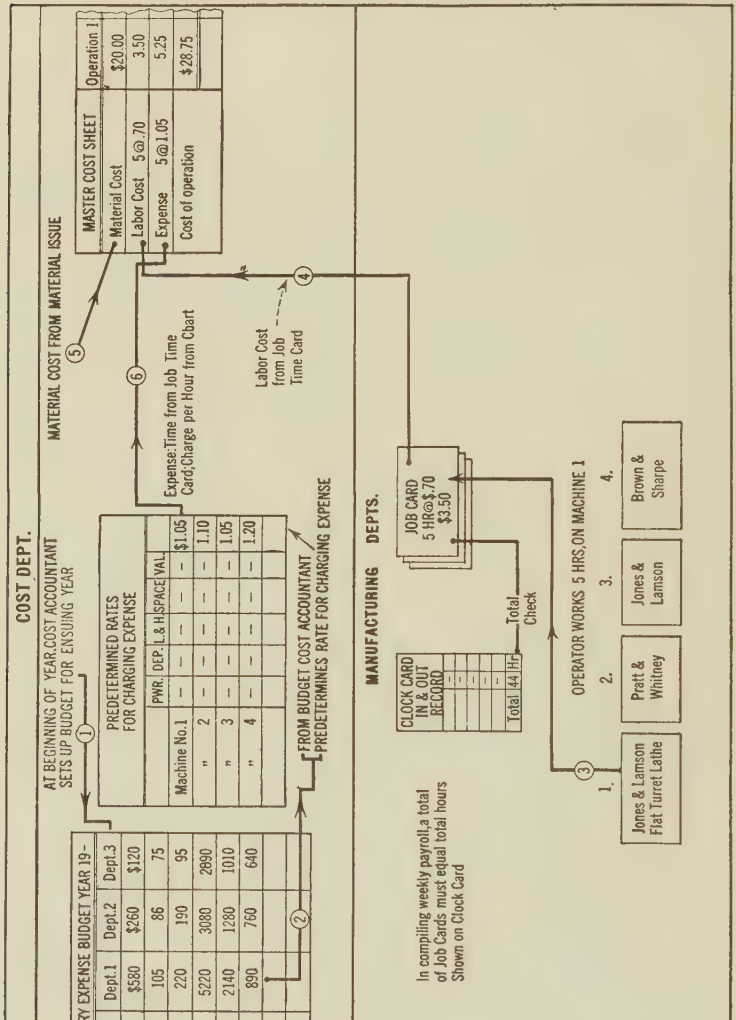


Fig. 33.—Procedure for predetermining and distributing expense.

tory, and that they will be read and studied, particularly in connection with the problems that follow in Chap. XIII (see Figs. 30, 31, 32, and 33).

It is further deemed advisable that the student or executive know something of the so-called "Taylor mechanisms" which are so widely used in industry today. A conception of these may be obtained by a study of Fig. 34, which was devised to present these rather involved procedures to industrial engineering students. In this diagram all office functions are shown above the heavy horizontal line and all shop functions are shown below it. Full lines indicate the paths of orders and instructions moving downward, while dotted lines indicate the paths of records and returns moving upward. Let it be assumed that a sales order has been received from the sales department. This order will first be approved by the credit department under the controller or corresponding official. If so approved, it will pass to the factory manager who will issue such production orders as may be necessary. In routine work, this is frequently accomplished as indicated in the diagram, the approved sales order serving as a production order, copies being sent to the superintendent of the planning department and to the engineering department.

The superintendent of planning will now divide the work called for by the production order into such items as may seem desirable, and will issue a manufacturing order for each item. He will also lay out the master schedule for the entire work, and fix the important dates of delivery, etc., for each item. All of this information will then be forwarded to the route clerk. The engineering department will prepare or furnish all drawings, drawing lists, specifications, and bills of material. The drawings and drawing lists will also identify each part by number or symbol. All of these documents will also be forwarded to the route clerk.

The route clerk will now lay out the route sheet for each machine part or lot of parts to be produced. Or, if a combined route and schedule sheet is in use, he will prepare those sheets, calling upon the time-study department for any information he may need regarding the total time required for the several operations, and with due regard to the work already scheduled upon the planning board. He will then forward the route sheets, drawings, specifications, etc., to the route-file clerk.

The route-file clerk will then proceed as follows for each operation called for upon the planned operation sheets: First, if material is to be drawn from stores for the operation, he will

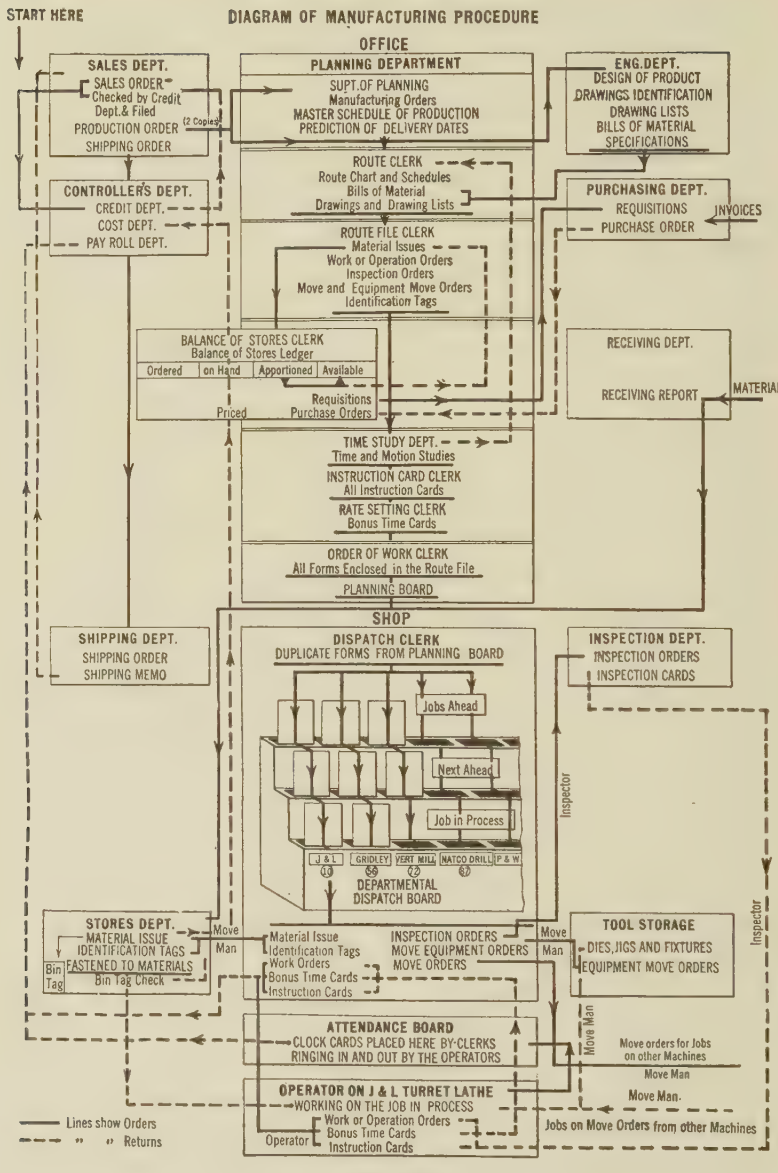

START HERE
DIAGRAM OF MANUFACTURING PROCEDURE
OFFICE
SALES DEPT.
SALES ORDER
Checked by Credit Dept. & Filed
PRODUCTION ORDER (2 Copies)
SHIPPING ORDER
PLANNING DEPARTMENT
SUPT. OF PLANNING
Manufacturing Orders
MASTER SCHEDULE OF PRODUCTION
PREDICTION OF DELIVERY DATES
ENG. DEPT.
DESIGN OF PRODUCT
DRAWINGS IDENTIFICATION
DRAWING LISTS
BILLS OF MATERIAL
SPECIFICATIONS
CONTROLLER'S DEPT.
CREDIT DEPT.
COST DEPT.
PAY ROLL DEPT.
ROUTE CLERK
Route Chart and Schedules
Bills of Material
Drawings and Drawing Lists
PURCHASING DEPT.
REQUISITIONS
PURCHASE ORDER
INVOICES
ROUTE FILE CLERK
Material Issues
Work or Operation Orders
Inspection Orders
Move and Equipment Move Orders
Identification Tags
BALANCE OF STORES CLERK
Balance of Stores Ledger
Ordered
on Hand
Apportioned
Available
Requisitions
Priced
Purchase Orders
RECEIVING DEPT.
RECEIVING REPORT
MATERIALS
TIME STUDY DEPT.
Time and Motion Studies
INSTRUCTION CARD CLERK
All Instruction Cards
RATE SETTING CLERK
Bonus Time Cards
ORDER OF WORK CLERK
All Forms Enclosed in the Route File
PLANNING BOARD
SHOP
SHIPPING DEPT.
SHIPPING ORDER
SHIPPING MEMO
DISPATCH CLERK
DUPLICATE FORMS FROM PLANNING BOARD
Jobs Ahead
Next Ahead
Job in Process
J & L
GRIDLEY
VERT MILL
NATCO DRILL
P & W
DEPARTMENTAL DISPATCH BOARD
INSPECTION DEPT.
INSPECTION ORDERS
INSPECTION CARDS
Inspector
STORES DEPT.
MATERIAL ISSUE
IDENTIFICATION TAGS
FASTENED TO MATERIALS
Bin Tag
Bin Tag Check
Move Man
Material Issue
Identification Tags
Work Orders
Bonus Time Cards
Instruction Cards
INSPECTION ORDERS
MOVE EQUIPMENT ORDERS
MOVE ORDERS
Move Man
TOOL STORAGE
DIES, JIGS AND FIXTURES
EQUIPMENT MOVE ORDERS
Inspector
ATTENDANCE BOARD
CLOCK CARDS PLACED HERE BY CLERKS
RINGING IN AND OUT BY THE OPERATORS
Move Man
Move orders for Jobs on other Machines
Move Man
OPERATOR ON J & L TURRET LATHE
WORKING ON THE JOB IN PROCESS
Operator
Work or Operation Orders
Bonus Time Cards
Instruction Cards
Move Man.
Jobs on Move Orders from other Machines
Lines show Orders
" " Returns

FIG. 34.

inquire of the balance-of-stores clerk whether the required material is on hand. If it is on hand, the balance-of-stores clerk reserves the necessary amount and deducts the material so apportioned from available stores. If the material required is not on hand, the balance-of-stores clerk will make a requisition upon the purchasing department which will purchase the material and have it on hand when needed; the entire transaction being reported back to the route-file clerk. The route-file clerk will now write all orders for issuing materials from stores or the necessary move order, if the work is to be brought from some other machine. He will make out the necessary orders for procuring tools and equipment; the identification tags that are to be attached to the work and move with it; and, lastly, he will make out the operation orders and the instructions to the inspector concerning the times for inspection. For convenience, the operation order, the identification tag, the move order, etc., that pertain to each operation may be placed together in an envelope sometimes called a "job" or "operation envelope," and these, with the route sheets, or planned operation sheet, the drawings, and other general directions pertaining to the work scheduled, may all be placed in a larger envelope or container known as a "route file" and forwarded to the time-study department. Here the instruction-card clerk will furnish an instruction card for each operation, if such a card is to be used, and the rate-setting clerk will furnish the proper time card, piece work, or bonus card as may be needed, each of these being placed in the operation envelope to which they belong. The relation of these several documents to each other may be more clearly understood by an examination of Fig. 35 which shows these relations completely for a single manufacturing order.

The order-of-work clerk has charge of the planning board and correlates it with the several departmental dispatch boards. When he receives the route file for a given machine or product, he retains the route sheets or planned operation lists, and he assigns each operation to be performed to the machine or production center for which it has been routed, by removing the duplicate work order and other duplicate documents necessary for complete identification and control of the operation from the operation envelope, and placing them on the planning board, upon the hooks, or in the pockets controlling the particular machine to which the work is assigned. The operation envelope,

with its remaining duplicate contents, is placed in corresponding position upon the departmental dispatch board controlling the production center or process to which the work is assigned. The order-of-work clerk will do this for each operation for which the route file contains operation envelopes, placing them so that the work orders are in the sequence called for by the scheduled time of performance.

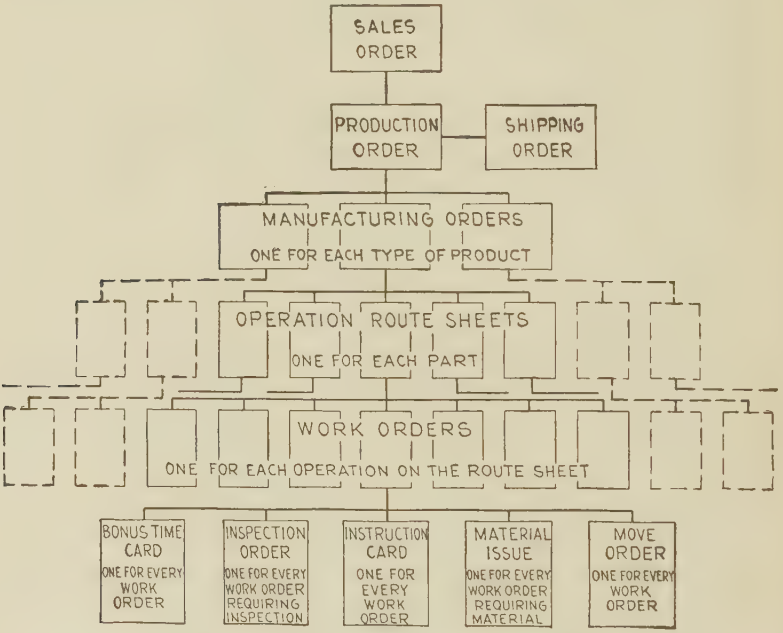


FIG. 35.—Development of Manufacturing Orders.

Let it be assumed that the first of these machines or processes, to which work has been so assigned, is a Jones and Lamson turret lathe No. 50, as shown in Fig. 34; and let it be assumed, furthermore, that there is plenty of work ahead of it so that this particular work order and its related instructions in the operation envelope are placed in proper sequence in the upper or jobs-ahead pocket of the planning board. In due process of time, the envelope, will be advanced to the second or next-job pocket, corresponding changes, of course, being made upon the departmental dispatch board.

When the work order has been advanced to this position, the dispatch clerk takes the material-issue order from the operation

envelope, if material is to be drawn from stores, and, also, the identification tags that are to be fastened to the work bearing the identification numbers, etc., and gives them to the move man. The move man, with this authority, draws the material, tags it, and moves it to the machine. When this is completed, he signs the material-issue order and returns it to the stores clerk. The stores clerk, upon the delivery of the material, makes entries upon his bin-tag records and forwards the material issue to the balance-of-stores clerk who enters it upon his balance-of-stores records, prices the material issue, and forwards it to the cost department where it is charged up against the cost of the production order. If no material is to be drawn from stores, but is to be moved from some other machine, the same procedure applies except that in this case the stores are not involved.

The dispatch clerk also issues the equipment orders to the move man, who, with this as authority, procures all special tools and appliances and brings them to the machine in advance of the beginning of operations.

Let it now be assumed that the operator on machine No. 50 has finished the job in process. He takes his operation order, instruction card, and time card, etc., to the dispatch station and returns them to the dispatch clerk who stamps the time upon the time card. The dispatch clerk now takes the duplicate documents pertaining to the work just completed from the work-in-process pocket and advances the corresponding documents of the job next in order to that position. He stamps the time upon the time card in this new set and gives it to the workman with the work order, instruction card, etc., for the new operation. The workman then returns to his machine and starts the new operation for which complete preparation has been made. The dispatch clerk also issues the new inspection orders to the inspector. The move man takes the work just completed on machine number 50 to the next machine listed upon the route, and returns all tools and fixtures to the tool storage. The dispatch clerk returns all work orders, drawings, drawing lists, etc., to the order-of-work clerk who checks the completed operation on the planned operation list. The time cards are sent to the controller's department where they are first checked against the attendance-board record or time-clock record, depending upon which is in use, and then used as a basis for the payroll. They are

then forwarded to the cost department where, with the material issues, they form the basis of productive costs.

The foregoing discussion describes a complete plan of production control based on Taylor's methods, and typical of a number of such plans now in actual use.

PART II

CHAPTER XIII

ACCOUNTS AND STATEMENTS OF A MANUFACTURING BUSINESS

OBJECT OF CHAPTER: To study the fundamental types of industries, and to show their effect upon the cost system. To solve representative problems illustrating the use of various accounts, and to follow these through to the final statements.

General Classes of Manufacturing Industries.[1]

Manufacturing industries may be divided into two general classes based upon the nature of the process they are performing. The type of industries in which the raw material goes in at the receiving end of the plant, flows continuously through a relatively small number of processes, and appears at the shipping room as a finished product is known as a "continuous process industry."

On the other hand, there are industries which take many kinds of raw materials, carry them through a varied number of processes and operations, store the parts finished, and then assemble them as the sales department needs them. Such industries are called "intermittent" or "interrupted process industries."

A brief classification will be of aid in seeing the effect upon the cost and accounting systems brought about by this natural division of industries.

1. Continuous Process Industries
   - *A*. Analytical type, separating natural products into component parts:
     - *a*. Salt products.
     - *b*. Ore products.
     - *c*. Oil products.
     - *d*. Sugar refineries.
     - *e*. Saw mills.

[1] KIMBALL, D. S., "Principles of Industrial Organization," pp. 91 and 92, 1925.

B. Synthetical type, building up a few natural products into some other form.

a. Paint works.

b. Wall-paper factories.

2. Intermittent or Interrupted Process Industry

A. Shipbuilding plants.

B. Plants manufacturing electrical machines.

C. Agricultural implement works.

D. Machine tool works.

There is, however, in industry, a tendency towards the continuous type, a good example of which is furnished by the automobile industry where the continuous flow idea by means of conveyors is outstanding. The typewriter industry is also rapidly becoming continuous.

In large plants, like the Westinghouse and the General Electric, essentially intermittent industries, certain departments are of a highly continuous nature because of the emphasis of modern division of labor and specialization. Thus, there may be a combination of the continuous and intermittent principle within the same industry.

The Effect of Continuous and Intermittent Industries upon the Cost and Accounting System.

In a perfectly natural way the type of industry has influenced the accounting system. A salt plant or sugar refinery will have a relatively simple system. In such industries the product is *not* handled in individual lots of specific orders but is "lumped" together, and the cost of the product is merely *averaged* over the product for the period considered.

In an intermittent-process industry, a plant making a large variety of different articles the cost problem is far more difficult and complex. It is found necessary (and practicable) to divide the work into specific lots or orders and keep costs on this basis.

These natural divisions have led to the establishment of two general types of cost systems, namely: (1) process costs, where the costs are kept by processes or departments; (2) order costs, where costs are kept according to specific orders.

Process costs are essentially average or lump costs, and are relatively simple to compile in comparison with order costs.

Process Costs.

Process costs usually apply to continuous industries. They are comparatively simple in operation and are based on the principle of collecting costs by departments. The materials

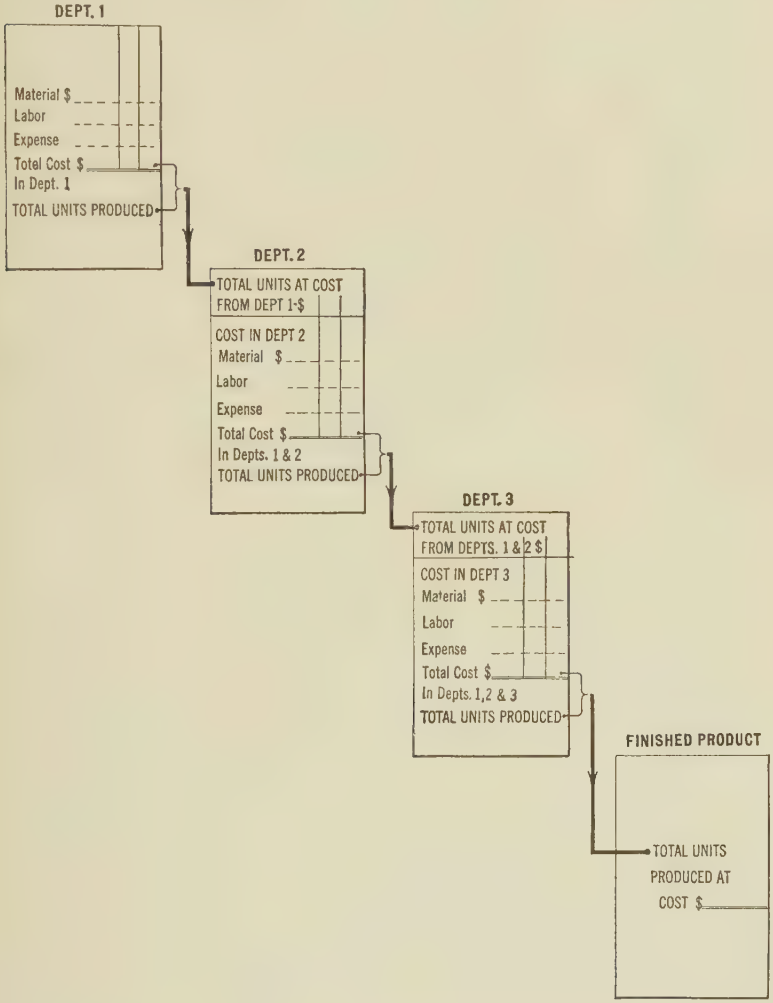


Fig. 36.

manufactured and the costs collected are then passed on to the other departments which follow the sequence of the flow of the product through the plant.

Figure 36 shows in diagram form the fundamentals of a process-cost system. Costs are collected by departments with the aid of the monthly cost sheet which shows in detail the costs flowing from department to department.

While it is not strictly true that all of the finished product of one department is transferred to the next, it is within the accuracy of most process-cost systems to ignore work in process. This is particularly true in salt plants, cement plants, sugar mills, ore refineries, etc., where the inventory is practically the same from period to period and small compared with the total output.

Certain types of continuous industries such as paint works, wall-paper factories, and tanneries, where there is apt to be a variation of the amount of inventory in process and also where it is apt to be of greater value, an estimation of its value and state of completion must be made.

In many cases, losses due to waste, breakage, spoilage, and other causes result in the diminishing of the number of units of production started. These losses must be borne by the remaining product and the cost per unit rises as a result of such losses.

A simple problem will illustrate the workings of the process-cost principle.

Problem 1.

A division of the Malcom Manufacturing Company turns out a uniform product by processing it in four departments, the die-casting department, the buffing and cleaning department, the japanning department, and the finishing department.

The following data is a section of the cost sheet for the month of January, 19—:

	Department 1 Die Casting	Department 2 Buffing and Cleaning	Department 3 Japanning	Department 4 Finishing
Material	$1,250	....	$160	$ 80
Labor	250	$ 60	155	100
Expense	148	46	30	32
Cost per department	$1,648	$106	$345	$212
Completed unit transferred to next department	5,000	5,000	4,000[1]	4,000
Cost per unit	.3296	$.0212	$.069	$.053
Cumulative cost per unit	$.3296	$.3508	$.4198	$.4728

[1] In the japanning department, 5,000 units were completed but to relieve the finishing department, 1,000 units were retained and stored there. It may be assumed that 3,500 units of the total delivered to the finished store room were sold to an outside customer.

This problem may be solved graphically to show the flow of product from process to process and is shown in this form in Fig. 37.

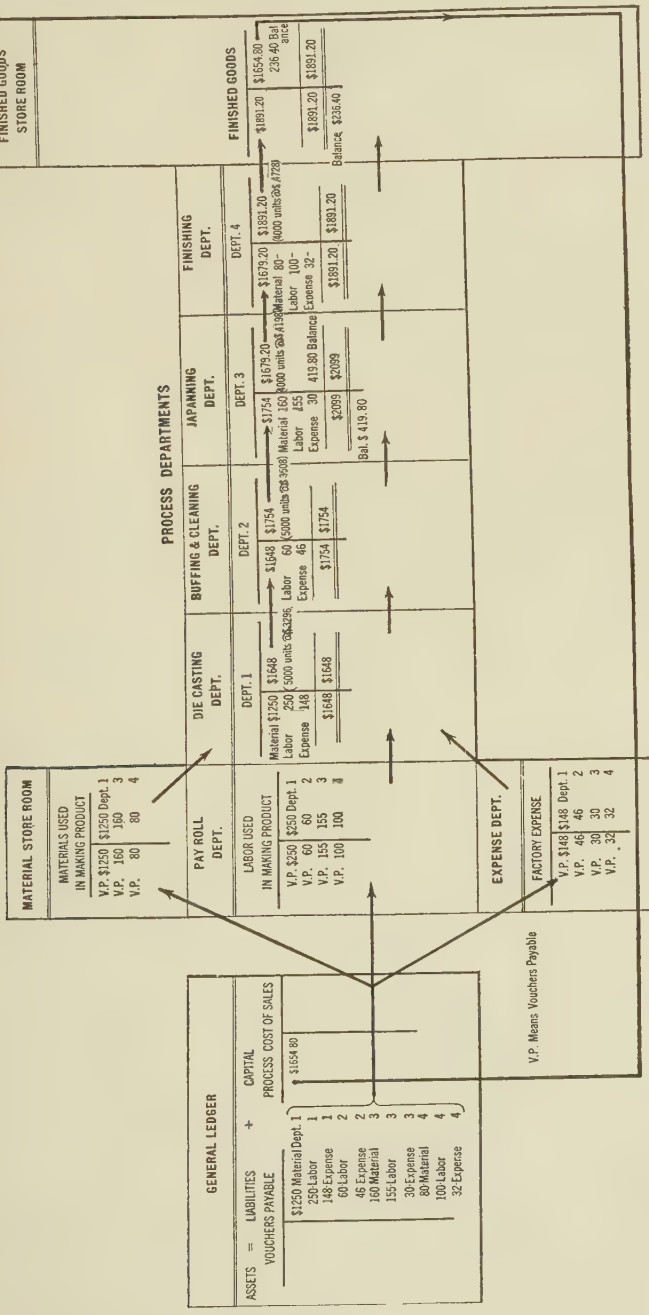


FIG. 37.

Fundamentals of Process-Cost System.

The fundamentals of the process-cost system may then briefly be summed up by the following statements:

1. It depends upon the accumulation of costs by departments.
2. It requires an accurate record in the form of a cost sheet of the amounts of the product produced to allow the calculation of unit costs.
3. It is based on "sequence costs," *i.e.*, costs must follow the sequence or flow of production (see Figs. 36 and 37).
4. In treating Work in Process at the end of the cost period it is considered accurate enough either to neglect such product entirely, or to make an estimate of its value.
5. It may be administered by means of the General Ledger accounts without the use of subsidiary ledgers.

Order Costs.

This relatively simple manner of spreading the total costs gathered over the products is quite limited in scope. The number of industries where the process is of an intermittent or interrupted nature is large, and the variety of types and sizes to be manufactured and costed is without number.

As a natural result, costing methods must be carried one step further and, instead of identifying the products merely by departments, a further step is taken. They are broken up into like lots or specific orders. Such costs are generally known as "order costs," material, labor, and expense being charged to a specific order number.

Another point of difference presents itself. The order-cost system calls for a large number of subsidiary records. The General Ledger Accounts are merely controls or totals for a number of detailed Perpetual Inventory Accounts which constitute what is generally known as the "cost system." This brings to mind the increasing complexity arising under the order-cost method because process costs are easily kept by means of the General Ledger Accounts. These subsidiary records and their relation to the General Ledger Accounts will be made clear by a study of Figs. 39, 40, 41, and 42 which follow in this chapter.

Statements and Accounts of a Manufacturing Business.

Overall Picture.[1]—Before going into the details of the order-cost system, an overall picture, shown in Fig. 38, of the major elements involved will simplify the approach.

This figure is self-explanatory and it shows in summary the various components of cost.

Certain definitions will be found essential before studying Fig. 38 in detail. The terms, "direct and indirect" will be used repeatedly in classifying labor and material.

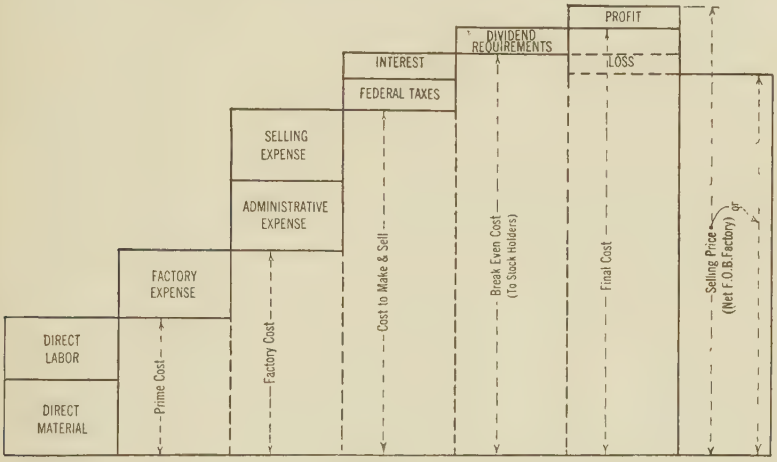


Fig. 38.[2]

Definitions.

A direct-cost item is one that can be charged to, or be identified with, a particular job or order. Examples: Direct materials; steel forging for gear blanks, copper wire used to wind armatures, etc.

Direct Labor; drill press operator drilling holes in a gear blank; operator winding armature coils.

An indirect-cost item is one that can not be charged to, or be identified with, a particular job or order but is the result of the general operation of the factory.

Examples: indirect materials; oil, waste, brooms, cutting fluids, etc.: indirect labor; oilers, sweepers, watchmen, foremen, superintendents, etc.

[1] Suggested by Bliss; "Management thru Accounts."

[2] See Bliss, "Management thru Accounts."

The use of the terms, productive and non-productive, instead of direct and indirect have crept into some of our industrial accounting literature. These terms should *not* be used because all materials and all labor tend toward the general production of the product. As one foreman said in discussing indirect labor, "If I had any man in my department who was non-productive, I'd fire him."

Indirect items find their way into costs through the Factory Expense Account, and are allocated to the product according to a predetermined scheme of distribution which will be developed later in the chapter.

Referring again to Fig. 38,

1. Prime cost; direct labor plus direct material, is easily obtained and may be charged directly to any specific job.

2. Factory cost; prime cost lus factory expense,[1] however brings in many difficulties.

The allocation of factory expense is the most difficult problem of industrial accounting because the amount of expense chargeable to a specific job must be *determined in advance.* In other words, a job going through the shop the first week in January must have its cost completely worked out long before the end of the month when all expenses are actually compiled. As the job goes through, it must receive its direct labor (from time cards) its direct material (from material lists, etc.) plus its share of the factory expense determined by some adequate scheme of distribution in advance of the actual accumulation of the expense. In distributing this expense, another factor enters in. As the productive load of the plant changes, expenses change with it, but *not in direct proportion* (see Fig. 50, Chap. XIV).

To quote from "Overhead Expenses—How to Distribute Them in Good and Bad Times," by Fabricated Production Department, Chamber of Commerce of the United States:

> There are expenses, which continue whether the plant is idle or in operation, expenses that moreover, bear no direct relation to output. Cost systems should provide that these expenses, usually designated as overhead expenses, should be absorbed and prorated on the basis of a normal year—that 100° mark on the business thermometer. Thus, in a season of unusual production, production exceeding normal, the over-

[1] The terms "factory expense," "factory overhead" and "factory burden" are synonymous but because of the more far-reaching meaning of the word "expense," the term "factory expense" will be used in this text.

head should be more than used up in costs, and a surplus out of overhead cost created to take care of those periods of the year when the output is below normal and the overhead charges not fully absorbed.

To take a very simple illustration: Let us assume the normal output of a department is 100 pieces and the overhead $100, or an overhead charge of $1 per item. If the department produces 150 pieces at a normal overhead charge of $1 per item, not only will the $100 overhead be used up but there will be an additional $50 as a reserve set up for lean periods. When the output of the department drops to 50 pieces, only $50 overhead will be applied to this reduced production, and the difference made up from the reserve established during unusual production. Then, in addition to seasonal fluctuations whole years are likely to be above or below what may be considered normal. In the case a year is below normal, for example, the variation from this established normal may be reflected readily through the amount of unabsorbed overhead.

This method of cost procedure has numerous advantages. For one thing it will eliminate the needless throttling of business by the impractical attempt to load subnormal production with greater charges than can or should be borne.

This procedure is rapidly becoming universal. To quote from the practice of one producer:

Our whole cost scheme consists, in the first place, of a budget made up the first of each year for every department, machine, and production center. This budget must naturally be based upon past experience plus an intelligent estimate of the possibilities for the year. The hours of operation, or the production units, are arrived at by taking an assumed 80% of possible operating time as a basis. In all these industries the standard week consists of 48 hours, or an 8-hour day. Deducting Sundays and holidays, we assume that the year consists of 300 working days of 8 hours each, or 2,400 hours. We take 80% of this, or 1,920 hours, as our normal unit. This figure, used in connection with our budget of expense and operation, gives us our normal rate.

If it were possible to operate the factory at exactly this normal point the amount of expense distributed and the actual expense would be the same. This is possible in theory only. As a result at the end of the period there will be a certain amount of under absorbed or overabsorbed expense previously mentioned which may be handled in various ways but eventually must find its way into profit and loss.

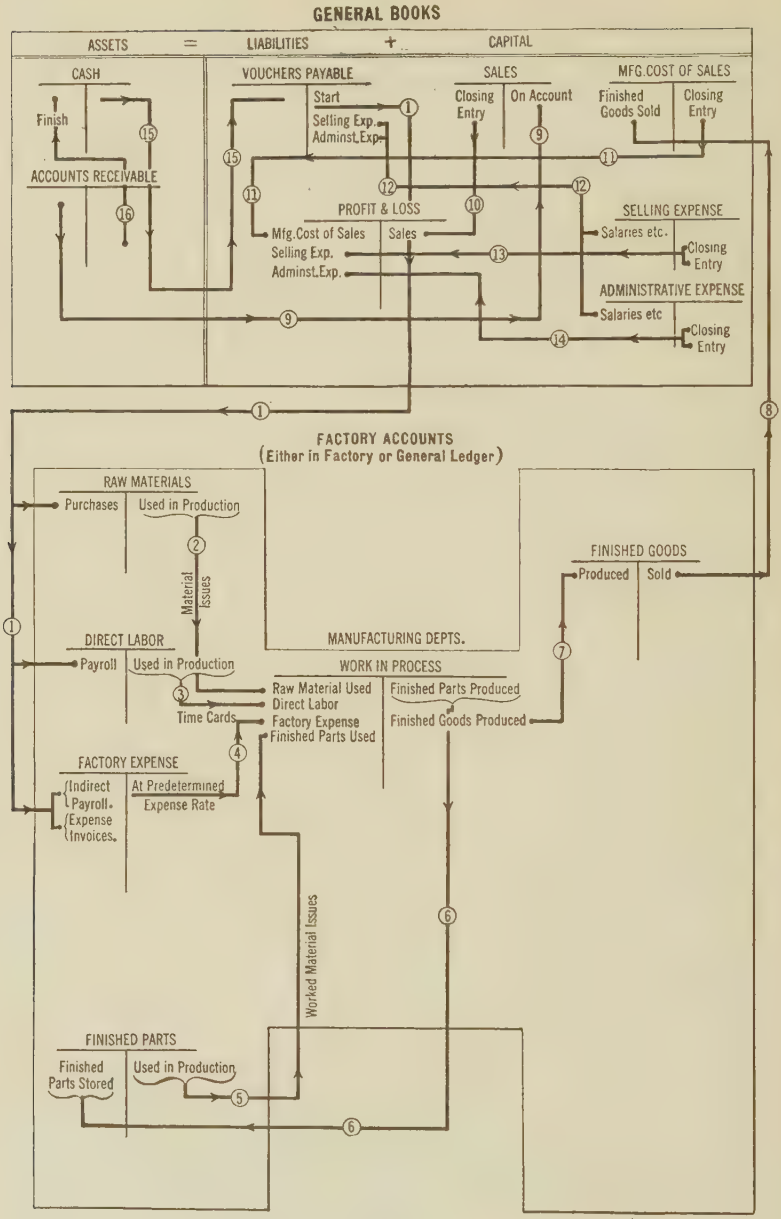

GENERAL BOOKS
ASSETS = LIABILITIES + CAPITAL
CASH
Finish
ACCOUNTS RECEIVABLE
VOUCHERS PAYABLE
Start
Selling Exp.
Adminst.Exp.
SALES
Closing Entry
On Account
MFG.COST OF SALES
Finished Goods Sold
Closing Entry
PROFIT & LOSS
Mfg.Cost of Sales
Sales
Selling Exp.
Adminst.Exp.
SELLING EXPENSE
Salaries etc.
Closing Entry
ADMINISTRATIVE EXPENSE
Salaries etc
Closing Entry
FACTORY ACCOUNTS
(Either in Factory or General Ledger)
RAW MATERIALS
Purchases
Used in Production
Material Issues
DIRECT LABOR
Payroll
Used in Production
Time Cards
MANUFACTURING DEPTS.
WORK IN PROCESS
Raw Material Used
Direct Labor
Factory Expense
Finished Parts Used
Finished Parts Produced
Finished Goods Produced
FINISHED GOODS
Produced
Sold
FACTORY EXPENSE
Indirect Payroll Expense Invoices
At Predetermined Expense Rate
Worked Material Issues
FINISHED PARTS
Finished Parts Stored
Used in Production

FIG. 39.

Overall Picture of Factory Accounts.

Figure 39 gives an overall picture of the factory and its connection with the general books. It shows a cash-to-cash cycle through the Factory Accounts. Truly, the operation is not as simple as shown here (see Problems 1, 2, and 3) but the fundamentals of industrial accounting and cost accounting are set forth.

The factory accounts, Raw Material, Finished Parts, Work in Process, and Finished Goods are known as "Perpetual Inventory Accounts," *i.e.*, at any time the balance represents the amount on hand. They are "controls" for subsidiary ledgers in which the details are kept. In these subsidiary ledgers running balances are kept and the terms, "Balance-of-Stores Ledger (raw material stores), Work-in-Process Inventory, and Balance-of-Stock Ledger" are used for them (see Figs. 19, 22, 41, and 42).

Review of Fundamental Principles and Their Extension to Manufacturing.

Before proceeding to the solution of a representative problem in factory accounts, a study and review of certain fundamental principles will be of value.

There are really no new principles involved in accounting for an industry. It is just a problem of expanding certain fundamentals, previously studied, to embrace the added activities of the factory.

The general formula used in the past may be stated as follows:

General Formula:

Initial inventory + Additions − Final inventory = Amount used.

Applying this to the trading business we have,

Initial inventory + Purchases − final Inventory = *Purchase* Cost of Goods Sold.

And by applying it to a manufacturing business we have,

First,

Initial Inventory Work in Process + Total Manufacturing Cost (Direct Labor + Direct Material + Factory Expense) − Final Inventory Work in Process = *Cost of Goods Manufactured.*

Second,

Initial Inventory Finished Goods + *Cost of Goods Manufactured* − Final Inventory Finished Goods = Manufacturing Cost of Sales (Cost of Goods Manufactured and Sold).

Problem 1.

1. Given,	Initial Inventory, Work-in-Process	$ 7,540.60
	Final Inventory, Work-in-Process	16,842.75
	Initial Inventory, Finished Goods	21,856.26
	Final Inventory, Finished Goods	18,352.87
	Materials Used	179,075.29
	Direct Labor	200,729.50
	Total Factory Expense	90,262.83
Find,	Cost of Goods Manufactured.	
	Manufacturing Cost of Sales.	

1. Initial inventory work-in-process + Total Manufacturing Cost − Final Inventory Work-in-Process = Cost of Goods Manufactured (as shown by completed cost sheets).

Direct Labor	$200,729.50
Direct Materials (materials used)	179,075.29
Factory Expense	90,262.83
	$470,067.62

$7,540.60 + $470,067.62 − $16,842.75 = $460,765.47 Cost of Goods Manufactured.

2. Initial Inventory Finished Goods + Cost of Goods Manufactured − Final Inventory Finished Goods = Manufacturing Cost of Sales (cost of goods manufactured and sold).

$21,856.26 + $460,765.47 − $18,352.87 = $464,268.86 Manufacturing Cost of Sales.

Problem 2 which follows shows the operation of the complete factory cycle from Cash in the General Ledger through the Factory Accounts and back through the General Ledger to Cash again.

Problem 2.

Let an ideal case be assumed in which all of the factory expense is distributed to orders going through during the month.

BROWNELL MANUFACTURING COMPANY

Balance Sheet, Jan. 1, 19—

(*A*) Cash	$ 50,000	Capital Stock	$1,000,000 (*A* + *B*)
Inventories		Vouchers Payable	15,550 (*a* + *b* + *c*)
(*a*) Raw Materials $3,550			
(*b*) Work in Process 4,500			
(*c*) Finished Goods 7,500	15,550		
(*B*) Plant, Fixtures, and Equipment	950,000		
	$1,015,550		$1,015,550

Jan. 2, 19— Raw Materials Purchased, $9,500.
3. Direct Labor Payroll, $2,800.
4. Indirect Labor Payroll, $1,155.
5. Rent of Factory, $1,200.
6. Insurance on Factory, $580.
7. Miscellaneous Factory Supplies, $195.
8. Raw Materials charged to orders going through shop, $7,100.
9. Work-in-Process finished as shown by completed cost sheets, $12,000.
10. Finished Goods shipped to customers, $6,380.
11. Sales to customers as shown by Accounts Receivable, $14,285.
12. Selling Expense, $3,500.
13. Administration Expense, $2,000.
14. All vouchers paid in cash.
15. All Accounts Receivable collected in cash.

The problem is to make entries in the general and the factory accounts, and to take off the statements.—See solution to Problem 2, page 222.

Effect upon the Statements.

It will be evident that by bringing in the added detail of the factory accounts the Profit and Loss Statement becomes rather unwieldy. Consequently, there is found the development of a new statement called the "Manufacturing Cost of Sales," the "Cost of Manufacture and of Sales," or the "Cost of Goods Manufactured and Sold" Statement (see page 223).

This statement may be developed for Problem 2, and it may be shown how the fundamental formulæ apply to it.

Page 224 shows the Profit and Loss statement to accompany page 223.

Another way of handling these statements is by segregating the Work-in-Process inventories and Cost of Manufacture items into a *Manufacturing Statement* and carrying all Finished Goods items into the Profit and Loss Statement.

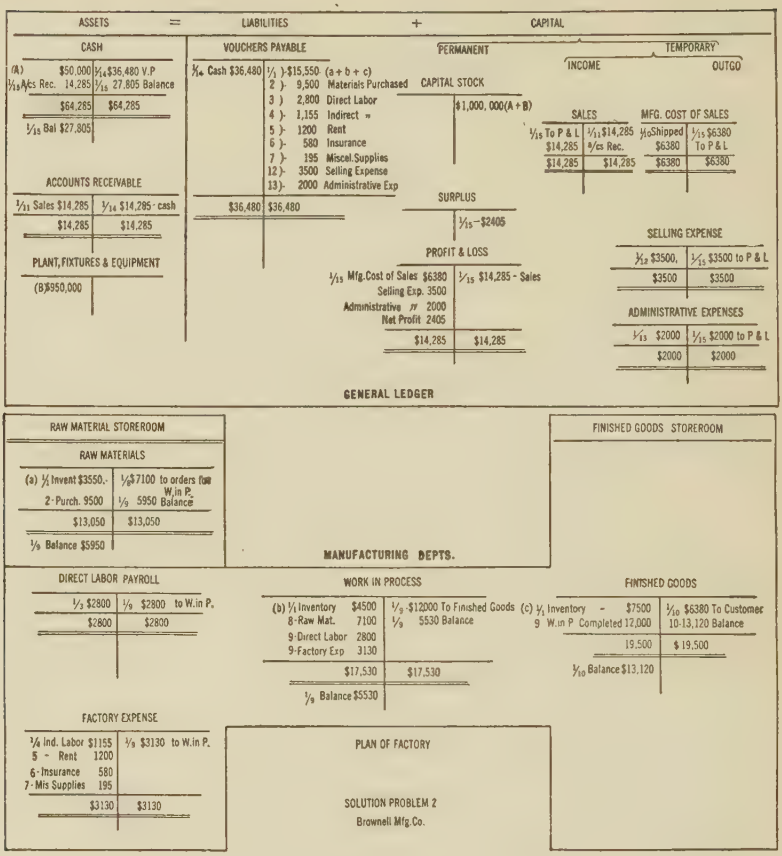


FIG. 40.
(See also Fig. 39.)

Statements of this character are shown on pages 224 (Exhibit C) and 225.

THE BROWNELL MANUFACTURING COMPANY

Statement of Cost of Manufacture and of Sales
Month Ending Jan. 31, 19—

Materials:		
Inventory of Raw Materials at Jan. 1, 19—	$ 3,550	
Purchases	9,500	
	$13,050	
Inventory of Raw Materials at Jan. 31, 19—	5,950	
Materials Used		$ 7,100
Direct Labor		2,800
Factory Expense:		
Indirect Labor	$ 1,155	
Factory Rent	1,200	
Factory Insurance	580	
Miscellaneous Factory Supplies	195	3,130
Total		$13,030
Subtract, Increase in Work-in Process inventory:		
Jan. 1, 19—	$ 4,500	
Jan. 31, 19—	5,530	1,030
Cost of Finished Goods		$12,000
Subtract Increase in Finished Goods Inventory:		
Jan. 1, 19—	$ 7,500	
Jan. 31, 19—	13,120	5,620
Cost of Manufacturing and of Sales		$ 6,380

(Exhibit A)

Application of Formulæ:

(1) Initial Inventory Work Process + Cost of Manufacturing − Final Inventory Work Process = Cost of Finished Goods.

$$\$4{,}500 + \$13{,}030 - \$5{,}530 = \$12{,}000$$

(2) Initial Inventory Finished Goods + Cost of Finished Goods − Final Inventory Finished Goods = Cost of Manufacturing and of Sales.

$$\$7{,}500 + \$12{,}000 - \$13{,}120 = \$6{,}380$$

THE BROWNELL MANUFACTURING COMPANY

Statement of Profits
Month Ending Jan. 31, 19—

Net Sales		$14,285	
Manufacturing Cost of Sales (Exhibit A)		6,380	
Gross Profit on Sales			$ 7,905
General and Administrative Expenses:			
Office Salaries	$ 500		
Officers' Salaries	1,200		
General Expense	300	$ 2,000	
Selling Expense:			
Salesmen's Salaries and Commissions	$1,600		
Salesmen's Expenses	825		
Advertising	1,075	3,500	5,500
Net Profit			$ 2,405

(Exhibit B)

THE BROWNELL MANUFACTURING COMPANY

Manufacturing Statement
Month Ending Jan. 31, 19—

Inventory of Work in Process, Jan. 1, 19—			$ 4,500
Manufacturing Costs during January:			
Raw Materials:			
Inventory, Jan. 1		$ 3,550	
Purchasing during January		9,500	
Total Material		$13,050	
Inventory, Jan. 31		5,950	
Cost of Raw Materials Used		$ 7,100	
Direct Labor		2,800	
Factory Expense:			
Indirect Labor	$1,155		
Factory Rent	1,200		
Factory Insurance	580		
Miscellaneous Factory Supplies	195	3,130	
Total Manufacturing Cost for January			$13,030
Total Goods to be accounted for			17,530
Inventory of Work in Process, Jan. 31			5,530
Cost of Goods Manufactured during January			$12,000

(Exhibit C)

THE BROWNELL MANUFACTURING COMPANY

Profit and Loss Statement
for Month Ending Jan. 31, 19—

Net Sales			$14,285
Manufacturing Cost of Sales:			
Inventory of Finished Goods, Jan. 1		$ 7,500	
Cost of Goods Manufactured (see Manufacturing Statement)		12,000	
Total to be Accounted for		$19,500	
Inventory of Finished Goods, Jan. 31		13,120	
Cost of Finished Goods Sold			$ 6,380
Gross Profit on Sales			$ 7,905
General and Administrative Expenses:			
Office Salaries	$ 500		
Officers' Salaries	1,200		
General Expense	300	$2,000	
Selling Expense:			
Salesmen's Salaries and Commission	$1,600		
Salesmen's Expenses	825		
Advertising	1,075	3,500	5,500
Net Profit			$ 2,405

(Exhibit D)

Underabsorbed and Overabsorbed Factory Expense.

In Problem 2, it was assumed that all of the factory expense had been allocated to jobs going through the factory during the month. This will rarely, if ever, happen. Usually, there will be a certain amount of expense which is either over-or underabsorbed. For example, if the factory operates below normal *not enough* expense will be absorbed, while if it operates above normal *more than enough* expense will be absorbed.

Let it be assumed that of the $3,130 expense (Problem 2) actually incurred during January only $2,990 was applied to orders going through the shop. This means that $3,130 − $2,990 or $140 was not absorbed (underabsorbed) by the January orders. Therefore, the work in process as shown by the completed cost sheets would be $12,000 − $140 or $11,860 and the cost of finished goods shipped to customers would equal $6,380 − $140 or $6,240. In T accounts this would be shown as follows:

Factory Expense

Actual Expense	$1,155	$2,990	Applied Expense
	1,200	140	Underabsorbed Expense
	580		
	195		
	$3,130	$3,130	

Work in Process

$ 4,500	$11,860
7,100	5,530
2,800	
2,990	
$17,390	$17,390
$ 5,530	

Finished Goods

$ 7,500	$ 6,240
11,860	13,120
$19,360	$19,360
$13,120	

Profit and Loss

Manufacturing Cost of Sales	$ 6,240	$14,285 Sales
Plus Underabsorbed Expense	140	
General and Administrative Expense	2,000	
Sales Expense	3,500	
Profit	2,405	
	$14,285	$14,285

It will be noted that the $140 of underabsorbed expense is closed into Profit and Loss and that in the last analysis the profit is the same. It can be seen, however, that not enough expense was charged to the product in going through the factory. By having a proper system of expense distribution each type of product bears its proper share. Thus in a factory where both large and small products are made, the small product, in absence of a proper method of distributing expense, often is charged with expense that rightly belongs to the larger product.

Another way of handling overabsorbed and underabsorbed expense is to close it into a special expense account at the end of each month. Over the period of a year there will be a tendency for it to balance out. The remainder is then closed into Profit and Loss for final statements and for income-tax purposes.

Such procedure is illustrated on page 227 for the same example:

Factory Expense			Work in Process		Finished Goods	
$1,155	$2,990	Applied Expense	$ 4,500	$11,860	$ 7,500	$ 6,240
1,200	140	Underabsorbed	7,100	5,530	11,860	13,120
580		Expense	2,800			
195			2,990			
$3,130	$3,130		$17,390	$17,390	$19,360	$19,360
			$ 5,530		$13,120	

Overabsorbed and Underabsorbed Expense

Underabsorbed Expense..... $140	
Underabsorptions of ensuing months	Overabsorptions of ensuing months

Profit and Loss

Manufacturing Cost of Sales.....	$ 6,240	$14,285 Sales
General and Administrative Expense	2,000	
Sales Expense.....	3,500	
Profit.....	2,545	
	$14,285	$14,285

It will be noted that under this plan the profit, $2,545 for January is $140 greater than under the first plan. At the end of the year, however, any remaining overabsorbed or underabsorbed burden will be closed into Profit and Loss and the net effect for the year will be identical under both schemes.

In this problem the sales figure was kept a constant, regardless of how the expense was distributed, it being assumed that the articles sold were priced at a standard figure. If, however, the sales figure was the result of a cost plus job order, direct material plus direct labor plus *applied expense* plus an established percentage for profit it can be readily seen how applying too much or too little factory expense will radically change the selling price.

Underabsorbed and Overabsorbed Administrative and Selling Expenses.

In much the same way that factory expenses are allocated to orders passing through the factory, administrative and selling expenses are *usually* allocated or "spread" according to a predetermined percentage over the manufacturing cost of goods sold.

Naturally, there is a certain amount of overabsorbed and underabsorbed expense which is handled in a manner similar to overabsorbed and underabsorbed factory expenses. The

solution of representative problems will illustrate the procedure of handling such expenses and also show how they are taken care of on the statements. (For fuller discussion of this important principle see Chap. XIV.)

Three Ways of Keeping Factory Accounts.

There are three ways in which Factory accounts are usually kept.

1. Without any connection with the general books.
2. Within the General ledger; the "Combined General and Factory Ledger Plan." (Fig. 41.)
3. Using a separate Factory ledger (Fig. 42) "tying in" the two sets of books by a "Factory Ledger Control" and a "General Ledger Control."

Number 1 is rapidly disappearing because of the evident disadvantage of lack of knowledge, coordination, and control.

Number 2 works well in small or medium-sized industries, while No. 3 is more prevalent among the larger companies. Where there is physical separation such as having the general offices at some distance from the factory, the advantage of No. 3 is clearly seen. In many instances, the factory and offices will be found in different cities.

Figures 41 and 42 are self-explanatory and after carefully studying them it will be possible to follow through the solution of two representative problems which illustrate their operation.

Problem 3 to illustrate combined Factory and General Ledger.

The following items represent ledger balances of the Trombley Machine Works, at the end of the year, 19—(see page 231).

Set them up in a Diagrammatic ledger and illustrate the closing process.

Draw up (*a*) Balance sheet, (*b*) Statement of Manufacturing Cost of Sales, (*c*) Statement of Profits, (*d*) Statement of Selling and Administrative Expenses, (*e*) Statement of Factory Expenses.

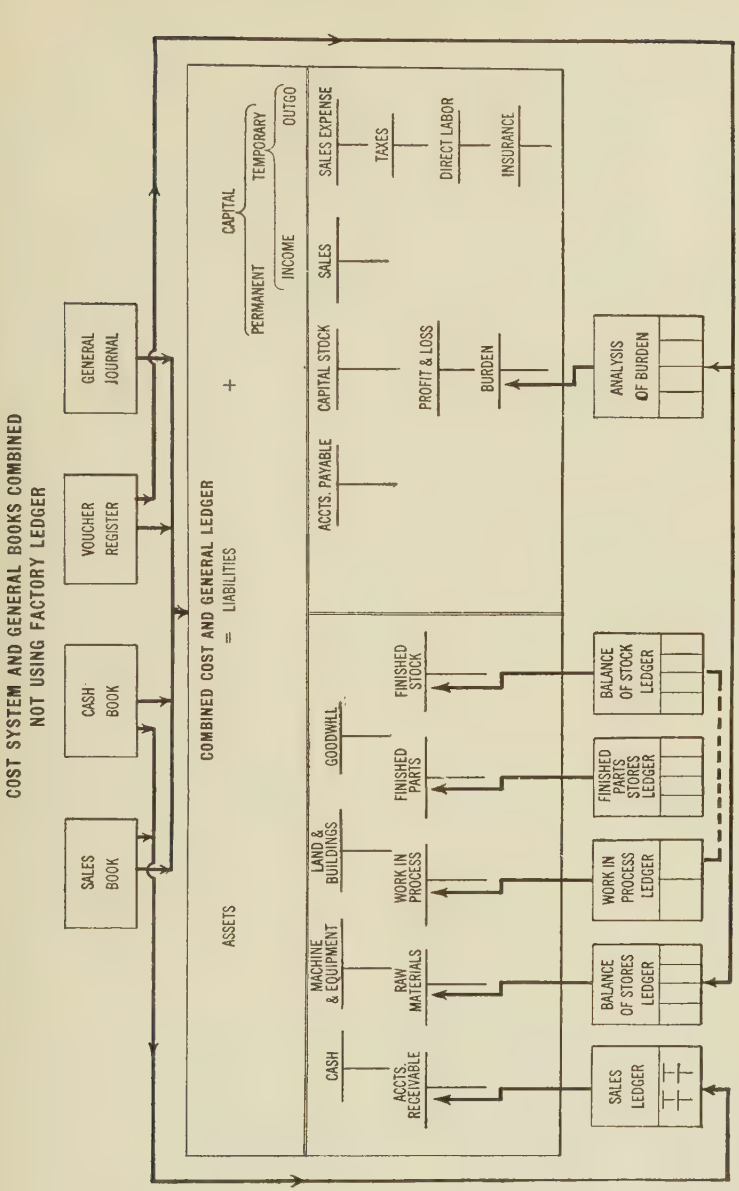

COST SYSTEM AND GENERAL BOOKS COMBINED
NOT USING FACTORY LEDGER
SALES BOOK
CASH BOOK
VOUCHER REGISTER
GENERAL JOURNAL
COMBINED COST AND GENERAL LEDGER
= LIABILITIES
+
ASSETS
CAPITAL
PERMANENT
TEMPORARY
INCOME
OUTGO
CASH
ACCTS. RECEIVABLE
MACHINE & EQUIPMENT
RAW MATERIALS
LAND & BUILDINGS
WORK IN PROCESS
GOODWILL
FINISHED PARTS
FINISHED STOCK
ACCTS. PAYABLE
CAPITAL STOCK
PROFIT & LOSS
BURDEN
SALES
SALES EXPENSE
TAXES
DIRECT LABOR
INSURANCE
SALES LEDGER
BALANCE OF STORES LEDGER
WORK IN PROCESS LEDGER
FINISHED PARTS STORES LEDGER
BALANCE OF STOCK LEDGER
ANALYSIS OF BURDEN

FIG. 41.

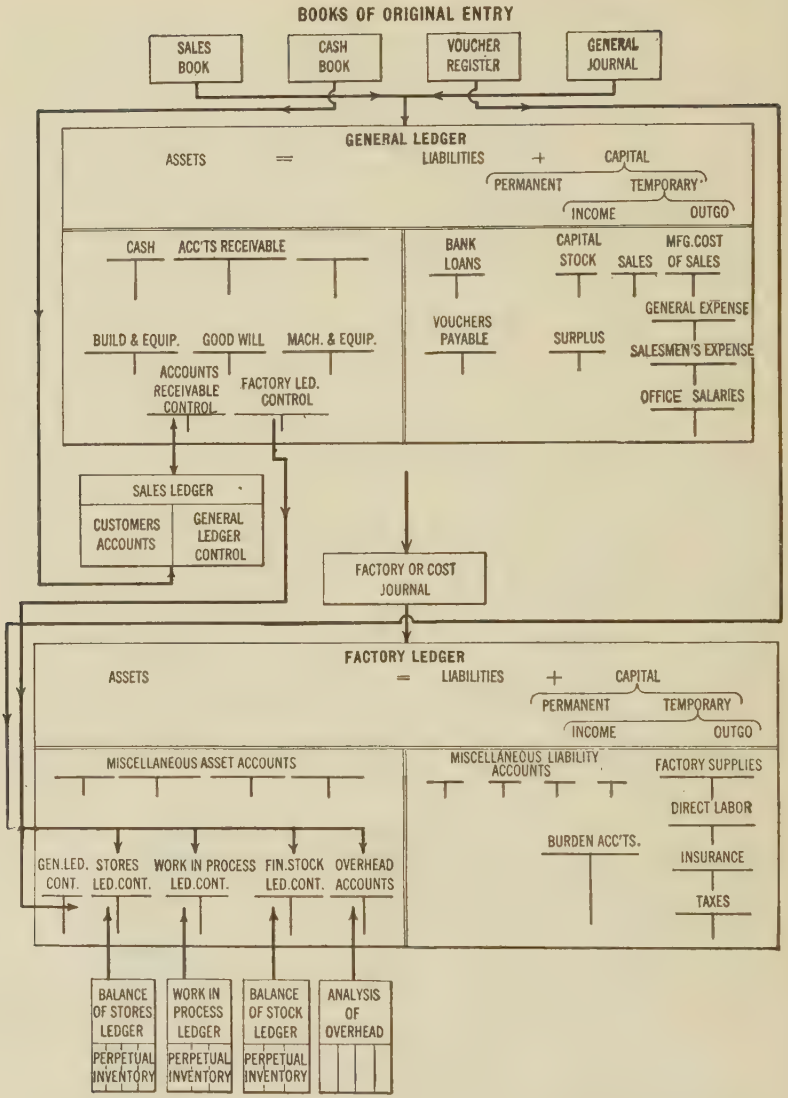


FIG. 42.—Cost system and general books. Using a separate factory ledger.

TROMBLEY MACHINE WORKS

Ledger Balance, Dec. 31, 19—

	Debit	Credit
Cash in Bank	$ 50,100	
Petty Cash	500	
Buildings	150,000	
Reserve for Depreciation of Buildings		$ 20,000
Land	45,000	
Machinery and Tools	185,000	
Reserve for Depreciation Machinery		45,000
Accounts Receivable	45,500	
Patent Rights	4,000	
Prepaid Taxes	750	
Accounts Payable		15,200
Mortgage		60,000
Preferred Stock		200,000
Surplus		126,300
Inventory Raw Materials, Jan. 1, 19—	8,900	
Inventory Work in Process, Jan. 1, 19—	6,500	
Inventory Finished Goods, Jan. 1, 19—	12,000	
Purchase of Raw Material	97,000	
Sales		269,000
Taxes	1,950	
Interest on Mortgage	1,500	
Direct Labor	65,000	
Indirect Labor	15,000	
Director's Fees	1,000	
Repairs to Machinery	10,500	
Heat, Light, and Power	5,500	
Shop Superintendence	5,000	
Salesmen's Salaries	8,000	
Office Salaries	10,000	
Insurance on Equipment	1,000	
Sales Discounts	5,800	
	$735,500	$735,500

Additional Information

Accrued Interest on Mortgage	$ 1,500
Depreciation Expense, Building, 3%	
Depreciation Expense, Equipment, 5%	
Final Inventory, Raw Materials	10,200
Final Inventory, Work in Process	5,200
Final Inventory, Finished Goods	8,200
Expense distributed to orders going through the shop	50,000
General administrative and Selling Expenses distributed	25,000

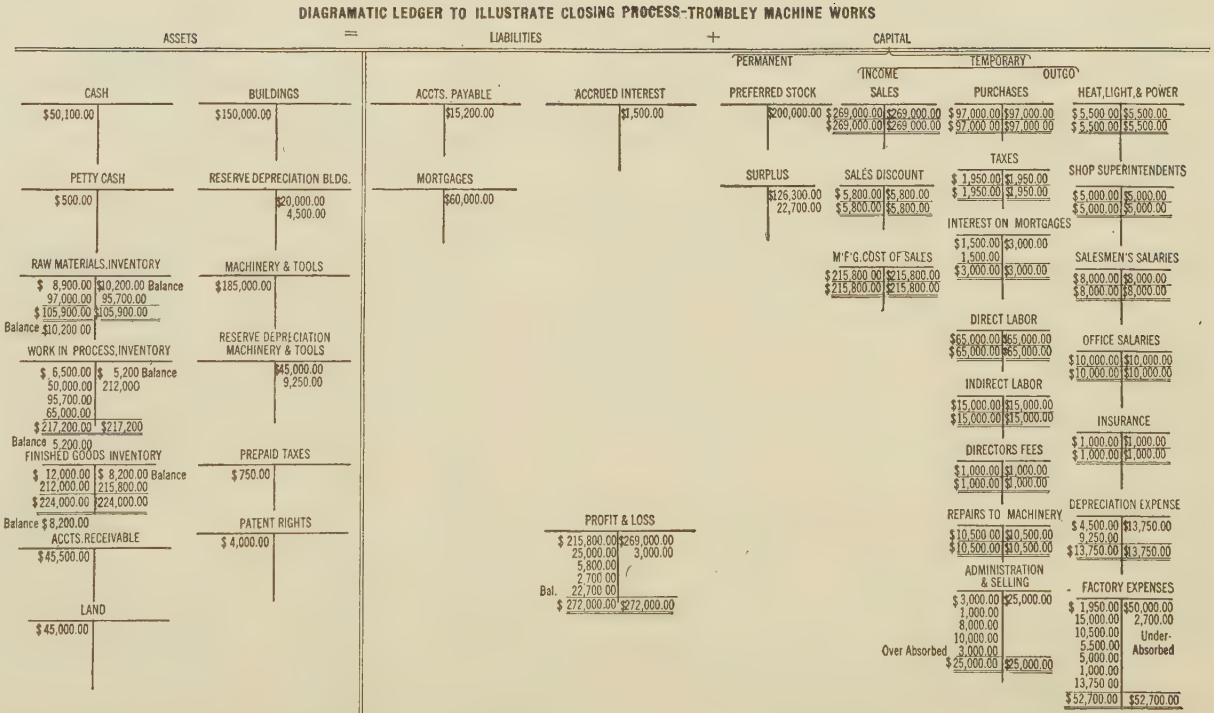


FIG. 43.—Solution to Problem 3, page 228.

TROMBLEY MACHINE WORKS

Balance Sheet
as of Dec. 31, 19—

Assets

Current:				
Cash, in Bank		$50,100		
Petty		500	$ 50,600	
Accounts Receivable			45,500	
Inventory:				
Raw Materials		$10,200		
Work in Process		5,200		
Finished Goods		8,200	$ 23,600	
Total Current Assets				$119,700
Fixed:				
Land			$ 45,000	
	Original Value	Reserve		
Buildings	$150,000	$24,500	$125,500	
Machinery and Tools	185,000	54,250	130,750	
Total Fixed Assets				$301,250
Patents			$ 4,000	
Prepaid Taxes			750	$ 4,750
Total Assets				$425,700

Liabilities and Capital

Current:			
Accounts Payable		$ 15,200	
Accrued Interest		1,500	
Total Current			$ 16,700
Fixed:			
Mortgages		$ 60,000	
Total Fixed			$ 60,000
Net Worth, Preferred Stock		$200,000	
Surplus, Jan. 1, 19—		126,300	
Net Profit for year		22,700	
Total Net Worth			$349,000
Total Liabilities and Capital			$425,700

TROMBLEY MACHINE WORKS

Statement of Cost of Manufacturing and of Sales
Year Ending Dec. 31, 19—

Materials:		
Inventory Raw Materials, Jan. 1, 19—	$ 8,900	
Purchases	97,000	
Less Inventory of Raw Material, Dec. 31, 19—	10,200	$ 95,700
Direct Labor	65,000	
Factory Expense Applied	50,000	$115,000
Total		$210,700
Add, Decrease in Work-in-Process Inventory:		
Jan. 1, 19—	$ 6,500	
Dec. 31, 19—	5,200	1,300
Cost of Finished Goods		$212,000
Add, Decrease in Finished Goods Inventory:		
Jan. 1, 19—	$12,000	
Dec. 31, 19—	8,200	$ 3,800
Cost of Goods Manufactured and Sold		$215,800

TROMBLEY MACHINE WORKS

Statement of Profit and Loss
for Year Ending Dec. 31, 19—

Gross Sale		$269,000
Deduct:		
Sales Discounts	$ 5,800	5,800
Net Sales		$263,200
Deduct:		
Cost of Goods Sold	$215,800	
Add Underabsorbed Factory Expenses	2,700	218,500
Gross Profit on Sales		$ 44,700
Deduct:		
Selling and Administrative Expense Applied	$ 25,000	
Less overabsorbed Selling and Admin. Expense	3,000	22,000
Net Profit		$ 22,700

TROMBLEY MACHINE WORKS

Statement of Selling and Administrative Expenses
for Year Ending Dec. 31, 19—

Salesmen's Salaries	$ 8,000	
Total Selling Expenses		$ 8,000
Office Salaries	$10,000	
Directors' Fees	1,000	
Interest on Mortgage	3,000	
Total Administrative Expenses		14,000
Grand Total		$22,000
Deduct Selling and Administrative Expense Applied		25,000
Overabsorbed Selling and Administrative Expense		$ 3,000

TROMBLEY MACHINE WORKS

Statement of Factory Expenses
for Year Ending Dec. 31, 19—

Factory Expenses:		
Taxes	$ 1,950	
Indirect Labor	15,000	
Repairs	10,500	
Heat, Light, and Power	5,500	
Shop Superintendence	5,000	
Insurance	1,000	
Depreciation	13,750	
Total Factory Expense		$52,700
Deduct Factory Expense Applied		50,000
Underabsorbed Factory Expense		$ 2,700

Postclosing Trial Balance

Cash:			
In bank	$50,100		
Petty	500	$ 50,600	
Merchandise Inventory:			
Raw Materials		10,200	
Work in Process		5,200	
Finished Goods		8,200	
Accounts Receivable		45,500	
Land		45,000	
Buildings		150,000	
Reserve for Depreciation Buildings			$ 24,500
Machinery and Tools		185,000	
Reserve for Depreciation Machinery and Tools			54,250
Prepaid Taxes		750	
Patent Rights		4,000	
Accounts Payable			15,200
Mortgages			60,000
Accrued Interest			1,500
Preferred Stock			200,000
Surplus			149,000
		$504,450	$504,450

Problem 4 to Illustrate Operation of Separate General and Factory Ledger.

The following items represent the ledger balances of the General and Factory Ledgers of the Spencer Tool Company, on Dec. 31, 19—(see page 236).

SPENCER TOOL COMPANY

Set them up in a Diagrammatic ledger and illustrate the closing process.

Draw up, (*a*) Balance Sheet, (*b*) Statement of Profits, (*c*) Statement of Manufacturing Cost of Sales, (*d*) Statement of Selling and Administrative Expense, (*e*) Statement of Factory Expenses.

GENERAL LEDGER BALANCE
Dec. 31, 19—

	Debit	Credit
Cash	$ 23,200	
Accounts Receivable	35,600	
Notes Receivable	15,000	
Buildings	78,000	
Reserve for Depreciation, Buildings		$ 14,000
Real Estate	15,000	
Machinery and Equipment	49,000	
Reserve for Depreciation, Machinery and Equipment		7,500
Patents	15,000	
Goodwill	20,000	
Accounts Payable		16,100
Mortgage		65,000
Accrued Taxes		750
Preferred Stock		100,000
Surplus		55,000
Sales		80,045
Sales Discount	650	
Sales Salaries	2,500	
Office Salaries	8,000	
Taxes on Office Building	75	
Insurance on Office Building	45	
Directors' Fees	450	
Interest on Mortgage	675	
Factory Ledger Control	75,200	
	$338,395	$338,395

Factory Ledger Balances

Inventory Raw Material and Purchases, Jan. 1, 19—	$39,725	
Inventory Work in Process, Jan. 1, 19—	6,200	
Inventory Finished Goods, Jan. 1, 19—	4,500	
Direct Labor	20,000	
Indirect Labor	3,500	
Insurance on Equipment and Factory	75	
Taxes on Factory	150	
Heat, Light, and Power	450	
Miscellaneous Factory Expense	600	
General Ledger Control		$75,200
	$75,200	$75,200

Additional Information

Depreciation Expense, Office Building	$ 125
Depreciation Expense, Factory Building	200
Depreciation Expense, Equipment	250
Final Inventory Raw Materials	7,200
Final Inventory Work in Process	10,300
Final Inventory Finished Goods	6,300
Factory Expense Applied	5,000
General Administrative and Selling Expense Distributed	12,000

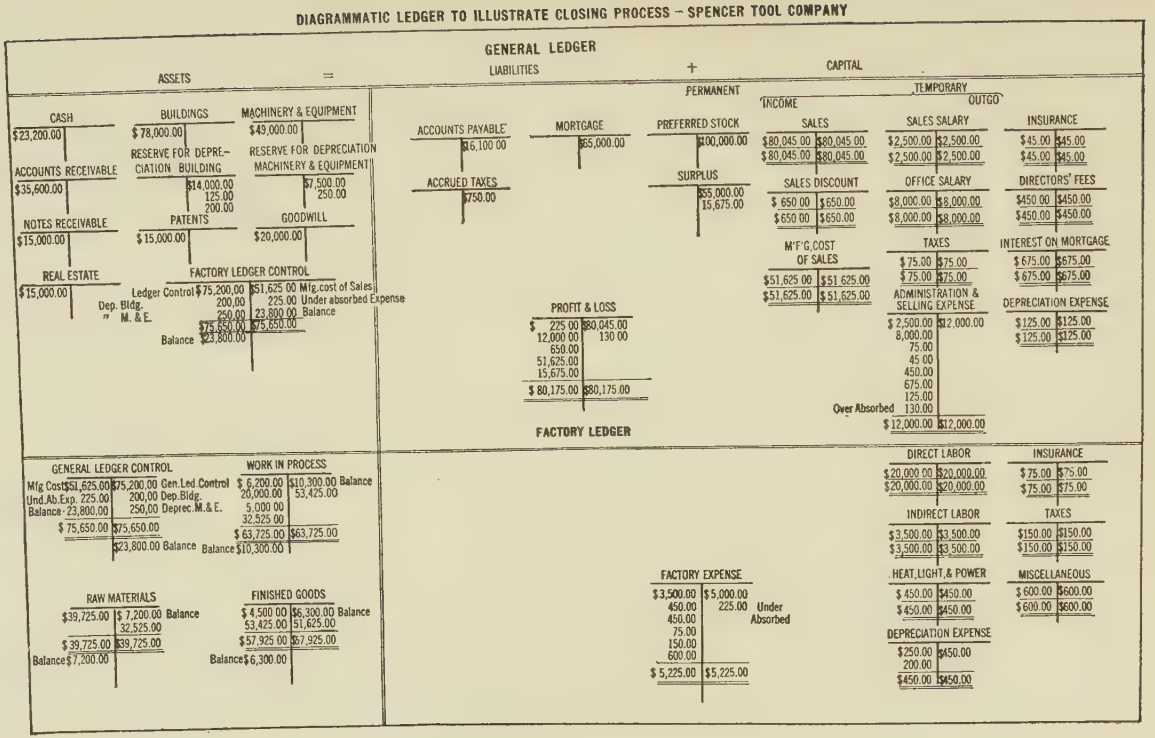


FIG. 44.—Solution to Problem 4, page 235.

SPENCER TOOL COMPANY

Balance Sheet
as of Dec. 31, 19—

Assets

Current:				
Cash			$ 23,200	
Accounts Receivable			35,600	
Notes Receivable			15,000	
Inventory, Raw Materials		$ 7,200		
Work in Process		10,300		
Finished Goods		6,300	23,800	
Total Current Assets				$ 97,600
Fixed:				
Land			$ 15,000	
	Original Value	Reserve		
Buildings	$78,000	$14,325	$ 63,675	
Machinery and Equipment	49,000	7,750	41,250	
Total Fixed Assets				$119,925
Patents			$ 15,000	
Goodwill			20,000	
Total Intangible Assets				$ 35,000
Total Assets				$252,525

Liabilities and Capital

Current:			
Accounts Payable		$ 16,100	
Accrued Taxes		750	
Total Current Liabilities			$ 16,850
Fixed:			
Mortgage		$ 65,000	
Total Fixed Liabilities			$ 65,000
Net Worth:			
Capital Stock		$100,000	
Surplus, Jan. 1, 19—		55,000	
Profit for Year		15,675	
Total Net Worth			$170,675
Total Liabilities and Capital			$252,525

SPENCER TOOL COMPANY

Statement of Profit and Loss
for the Year Ending Dec. 31, 19—

Gross Sales		$80,045
Deduct:		
Allowance on Sales	$ 650	650
Net Sales		$79,395
Deduct:		
Manufacturing Cost of Goods Sold	$51,625	
Plus Underabsorbed Factory Expense	225	51,850
Gross Profit on Sales		$27,545
Deduct:		
Selling and Administrative Expense Applied	$12,000	
Less Overabsorbed Expense	130	11,870
Net Profit on Sales		$15,675

SPENCER TOOL COMPANY

Statement of Cost of Manufacturing and Sales
for Year Ending Dec. 31, 19—

Materials:		
Inventory Jan. 1, 19— and Purchases	$39,725	
Inventory, Dec. 31, 19—	7,200	
Materials Used		$32,525
Direct Labor		20,000
Factory Expenses applied		5,000
Total		$57,525
Deduct Increase in Work-in-Process Inventory:		
Dec. 31, 19—	$10,300	
Jan. 1, 19—	6,200	$ 4,100
Cost of Finished Goods		$53,425
Deduct Increase in Finished Goods Inventory:		
Dec. 31, 19—	$ 6,300	
Jan. 1, 19—	4,500	1,800
Cost of Goods Manufactured and Sold		$51,625

SPENCER TOOL COMPANY

Statement of Selling and Administrative Expense
for Year Ending Dec. 31, 19—

Sales Salaries		$ 2,500
Administrative Expense:		
Office Salaries	$ 8,000	
Taxes on Office Building	75	
Insurance on Office Building	45	
Directors' Fees	450	
Interest on Mortgage	675	
Depreciation Expense on Office Building	125	
Total Administrative Expense		$ 9,370
Total		11,870
Deduct Selling and Administrative Expense Applied		12,000
Overabsorbed Selling and Administrative Expense		$ 130

SPENCER TOOL COMPANY

Statement of Factory Expense
for Year Ending Dec. 31, 19—

Factory Expenses:		
Indirect Labor	$3,500	
Heat, Light, and Power	450	
Depreciation Expense	450	
Insurance	75	
Taxes	150	
Miscellaneous	600	
Total		$5,225
Less Factory Expenses Applied		5,000
Underabsorbed Factory Expense		$ 225

Postclosing Trial Balance of General Ledger

Cash	$ 23,200	
Accounts Receivable	35,600	
Notes Receivable	15,000	
Real Estate	15,000	
Buildings	78,000	
Reserve for Depreciation Building		$ 14,325
Machinery and Equipment	49,000	
Reserve for Depreciation Machinery and Equipment		7,750
Patents	15,000	
Goodwill	20,000	
Accounts Payable		16,100
Accrued Taxes		750
Mortgage		65,000
Preferred Stock		100,000
Surplus		70,675
Factory Ledger Control	23,800	
	$274,600	$274,600

Postclosing Trial Balance of Factory Ledger Inventory

Raw Materials	$ 7,200	
Work in Process	10,300	
Finished Goods	6,300	
General Ledger Control		$ 23,800
	$ 23,800	$ 23,800

Diagrammatic Plan versus the Work-sheet Method.

It will be noted that all adjustments were made directly in the ledger. Actually such adjustments would be made on a work sheet, the statements taken off, and then the adjusting entries made in the journal and posted to the ledger in the same manner as illustrated in Part I for a trading business. Such a work sheet would have more columns than that of a trading concern, but the principle of operation is in every way the same. It is felt for clearness in teaching and presentation the diagrammatic scheme used offers many advantages and hence actual work-sheet problems are omitted.

SUMMARY

In Chap. XIII the following accounting points were emphasized:

1. A process-cost system is, in essence, a system of obtaining average costs.

2. The order-cost system is the keeping of costs by specific job or order number.

3. The allocation of factory expense is the most difficult problem of industrial accounting because the amount of expense chargeable to a specific job must be determined in advance.

4. The development of a new statement generally known as the "Manufacturing Cost of Sales Statement" or the "Cost of Goods Manufactured and Sold Statement" is necessary in manufacturing accounting.

5. The underabsorbed and overabsorbed factory expenses and the underabsorbed and overabsorbed administration and selling expenses are the natural result of predetermining such expenses.

6. Three ways of keeping factory accounts are (*a*) without any connection with the general books, (*b*) within the general ledger, (*c*) using a separate factory ledger.

CHAPTER XIV

METHODS OF DISTRIBUTING FACTORY EXPENSE

OBJECT OF CHAPTER: To study the most widely used methods of distributing factory expense.

Different Methods Used in Distributing Factory Expense.

There are a number of different methods used to distribute factory expense but probably the most widely used bases are

1. Direct Material.
2. Direct Labor.
3. Man-Hours.
4. Machine Rate.

Distribution on the Basis of Direct Material.

In such "single-purpose" plants as salt works, cement works, or saw mills, where the product is of a uniform nature, it is obvious that if the expense incurred during a certain period of time be evenly divided over the total production for the same period, the distribution will be correct. If operating conditions remain practically the same, only slight errors will be made if the expense incurred during the preceding period of time be used as a basis of allocation. Allocation or distribution, in a rigid sense, is not needed in such cases. What is required is merely the simple division of the factory expense over the product. If the product is variable in nature, however, such simple division methods no longer hold and the use of material values is apt to give erroneous results.

Example 1.

Direct Material Method.

Data: Total out put of plant for period, 50,000 bags of salt; total expense for period, \$25,000; estimated expense per bag for next period, $\frac{\$25{,}000}{\$50{,}000}$ or \$0.50 per bag. As the volume of product and expense is practically the same year in and year out, an expense charge of \$0.50 per bag is all that is necessary.

Distribution on the Basis of Direct Labor.

The direct-labor method is probably, because of its simplicity, the most widely used of all methods of distribution. It is based upon the supposition that the factory expense chargeable to a job is proportional to the direct labor that has been spent upon it. Expense is charged off as a certain percentage of the direct-labor payroll. In actual operation the percentage used is not that of the current period, but of the period just preceding it or the average of several preceding periods.

For work of practically the same size and character and having fairly constant wage rates, the direct-labor method may give satisfactory results. A factory, however, operating a varied line of machines such as drill presses, worth $450, to high-grade automatics, worth $6,000 to $10,000, will find the direct-labor method of distributing factory expense quite inaccurate as further description will verify.

Example 2.

Direct-labor Method:.

Data: Total direct-labor payroll, $60,000 for period.
Total expense for period, $90,000.

Estimated expense for next period, $\frac{\$90{,}000}{\$60{,}000} = 150\%$ or $1.50 for each dollar of payroll. It is not customary to refigure this each month but it is usually taken as being accurate enough and a possible check taken once a year.

Distribution on the Basis of Man-Hours.

By this method it is assumed that the expense chargeable to a job is proportional to the number of man-hours expended upon it. If all men received the same rate of pay, the system would give the same results as the direct-labor method, because then the labor cost would be in proportion to the time expended. Where wage rates vary, the man-hour method has the advantage over the direct-labor method of emphasizing the time element. It fails, however, to take into account the difference in size and value of the machines and workplaces used in performing the operations.

Example 3.

Man-hour Method

Data: Total number of men directly employed manufacturing product, 600.

Total number of hours worked during period, 2,000.

Total man-hours = 2,000 × 600 = 1,200,000.

Total expense, $480,000 for period.

Estimated expense for next period, $\frac{\$480{,}000}{1{,}200{,}000} = \$.40$ per man-hour.

Distribution on the Basis of Machine Rate.

In an effort to equalize, to a certain extent, the varying expense distributions caused by the use of machines and equipment of varying size and value, a plan known as the "machine-hour method," "machine-unit system," or more simply as the "machine-rate method" is used. It means simply that if a machine is operated for an hour, it shall be charged with a certain amount of expense in proportion to its size and cost. It is an old idea and antedates modern accounting and cost accounting methods. The theory behind this method is doubtless more accurate than that of the preceding methods discussed. Expenses do not naturally associate themselves with material, wages, or time, but tend to build up around machines, equipment, and processes.

In computing machine rates, all items of expense are allocated so that each machine, process, or workplace bears its own equitable share of the expense as nearly as it is possible to do so. These allocated expenses are totaled for each machine and divided by its *estimated* normal number of hours of operation. In other words, if the machine operates exactly according to its estimate, all expenses will be distributed, *i.e.*, there will be no overabsorbed or underabsorbed expense. This, of course, is possible only in theory.

Example 4.

Machine-rate Method

Data: Machine, No. 19. Inclinable Power Punch Press.

Normal annual expense, $4,120.

Normal annual machine hours of operation 1,320.

Machine rate per hour $\frac{\$4{,}120}{1{,}320} = \$3.11$

(See details of machine rate distribution, pages 248 to 257.)

Inadequacy of Direct-Labor and Man-Hour Methods of Distributing Expense in a Machine Shop with a Varied Line of Machinery.

The following chart, developed by Prof. M. A. Lee, Department of Industrial Engineering, Cornell University, shows how inadequate the direct-labor and man-hour methods may be under certain conditions.

	A	B	C	D
Time Taken.....	8-hour job	8-hour job	8-hour job	8-hour job
Operator's rate...	\$.50 per hour	\$.80 per hour	\$.50 per hour	\$.80 per hour
Type of production center....	Bench or cheap machine	Bench or cheap machine	Large expensive machine	Large expensive machine
Machine rate.....	\$.70 per hour	\$.70 per hour	\$1.50 per hour	\$1.50 per hour
TOTAL EXPENSE CHARGED TO JOB				
Direct-labor expense 100% of direct-labor cost.	8 × \$.50 × 1 = \$4.00	8 × \$.80 × 1 = \$6.40	8 × \$.50 × 1 = \$4.00	8 × \$.80 × 1 = \$6.40
Man-hour method 60¢ per man hour.....	8 × \$.60 = \$4.80	8 × \$.60 = \$4.80	8 × \$.60 = \$4.80	8 × \$.60 = \$4.80
Machine rate \$.70 per hour for bench or small machine \$1.50 per hour for large expensive machine.....	8 × \$.70 = \$5.60	8 × \$.70 = \$5.60	8 × \$1.50 = \$12.00	8 × \$1.50 = \$12.00

This chart shows rather forcibly that the direct-labor and man-hour methods give fallacious results where a varied line of machinery is used.

The direct-labor method gives values of \$4.00 \$6.40, \$4.00 and \$6.40 for jobs *A*, *B*, *C*, and *D*, respectively. In other words, jobs *A* and *C* with a 50-cent operator are charged \$4, while jobs

B and *D* with an 80-cent operator are charged $6.40. In jobs *C* and *D*, a large expensive machine is involved which should carry a larger expense charge. As a matter of fact, job *A* should carry the same or a greater expense charge than *B* because the 50-cent man is apt to require greater supervision. Jobs *C* and *D* should carry higher rates due to the added expense of running a large machine.

The man-hour method overcomes some of the difficulties encountered under the direct-labor method. Jobs *A* and *B* under this system will carry a comparable expense rate of $4.80 which is a reasonable one, both being bench jobs and using about the same amount of heat, light, and involving the same amount of general factory expense. Jobs *C* and *D*, however, also receive the same charge of $4.80, whereas the interest on the investment, depreciation, taxes, etc. on the large machine runs the actual expense to a much larger figure.

The machine-rate method gives a scientific distribution of expense, and, under this method, each of the bench jobs is charged $5.60, and each of the large machine jobs $12.00

Certainly the machine-rate method gives more accurate costs under such condition and, while its initial set-up is more difficult, as will be shown in the next section, a plant having a variety of processes and machines will find that the machine-rate method pays for itself in giving far more accurate costs.

In many plants using the direct-labor method, salesmen have great difficulty in selling certain smaller types of apparatus. Larger types of apparatus sell much more readily. The answer to such a problem is simple. Factory expense is being improperly allocated. The smaller parts getting more than their share of expense, and the larger parts not enough. This is the reason that a plant manufacturing just small parts can often undersell the larger company making a varied line. It all resolves itself into a question of properly distributing factory expense.

Details of the Machine-rate Method of Distributing Expense.

While the simple name, machine rate, was used in our discussion in the last section various other names, such as the "machine-unit system," the "machine-hour system," and the "loading-rate system" are used in various industries.

In describing the machine-unit system of operation in his company a prominent cost accountant, Mr. J. H. Scott, of one of our largest manufacturing industries, gives a very complete picture of this system as it has been in use for 20 years in that organization.

MACHINE-UNIT SYSTEM

The machine-unit system has been in satisfactory operation in our organization for about 20 years. It is conceded by most accountants that this system is the more accurate and more nearly approaches the ideal situation than any other yet devised for a concern engaged in the manufacture of many different kinds of equipment.

The chief objection to it is the one that applies to the expensive Easter hat on which the good wife always sets her heart. Something cheaper is usually substituted but it never proves to be quite as satisfactory.

Loading Rates.

It is not only necessary to establish standards of expense for the pur pose of control, but it is also necessary to distribute these standards of expense in such a way that the finished product will include its just and fair proportion of this expense.

In our concern we use the method commonly known as the "loading-rates system." This system provides for a standard rate per hour or unit. These loading rates are divided into two general classes, the more common one being a standard rate per hour for each productive machine in the plant; the other covers what we term "raw-material loading" which is our means of distributing the expenses of purchasing, handling, stocking, selecting, trucking, etc. of our raw material.

In the budget, we have our direct expenses or those expenses for which a department chief is directly responsible; such as, salaries in his organization, defective work, supplies, changes and repairs, and such items, which it is in his power to decrease through proper supervision and attention. Such items as insurance, taxes, and depreciation cannot be controlled by the foreman and, therefore, are not shown as a part of his direct expenses.

It is obvious that a clerical organization and a welfare organization would not have productive machines such as punch presses, drill presses, etc. It is, therefore, necessary to distribute the clerical expense and the welfare expense and such other non-productive expense by departments to organizations which they serve; in other words, the expense of all organizations not engaged in productive work must be absorbed by those departments which have productive work. The items of expense for which each organization chief throughout the plant is responsible are clearly defined. The general superintendent, for instance, is responsible

for the salaries of his superintendents, the salary of his secretary, the stationery which he uses, and a few items which he specifically authorizes charged to his own reference number. These expenses are distributed to each of his superintendents. The superintendents are responsible for the salaries of their division chiefs and other expenses which they incur for themselves similar to those incurred by the general superintendent. These expenses, plus the service charge from the general superintendent, are distributed to each of the divisions reporting to them.

A similar plan brings the expense from the division chief down to the department. One of the departments in the clerical branch is the Payroll department whose expense is distributed to all other organizations in the plant on the basis of employees paid.

The expense of the voucher department is distributed to each department based on the number of purchase orders which each department places upon the purchasing department.

In short, a study is made of the best possible means of distributing the expense of each department, taking into consideration the service performed and the results expected.

In addition to regular organizations, commonly found in a manufacturing plant, we have established what we call "arbitrary organization numbers" for the purpose of collecting such expenses as rent. We collect our rent charge under one of these numbers which is known as the "rent system." The expenses included in this system are the usual ones charged to rent, such as light, heat, depreciation, changes, repairs, insurance, taxes, janitor service, etc. The expense of this system is closed out on the basis of the total square feet of floor space occupied by each department.

There is considerable work involved in bringing these expenses down to the proper productive departments, but when we get through with the job we know that we have reliable figures. When the distribution is entirely completed, no expense remains in any department other than those engaged in productive work, but before establishing a loading rate it is necessary to further distribute these expenses over the productive machines in each productive department.

Most manufacturing concerns of any size have a punch press department. I will, therefore, take the punch press department as an example and show you how we distribute the expenses which were directly incurred in that department and which were transferred to that department by the method of distribution previously mentioned.

To the left of a large sheet of paper we show the expense classification, such as machinery, and under machinery, depreciation, fire protection, taxes, changes, and repairs. We follow the same plan with tools, patterns, furniture and fixtures, supplies, services from the clerical organization, the welfare organization, the production organization, the technical organization, services for power consumed, floor space occupied,

steam, water, gas and any other expense pertaining to the organization under discussion. (See Figs. 45 and 46.)

Before we go any further, I ought to say that each of our machines bears a stamped number plate showing the machine class assigned to it.

DEPT. LOADING CLASS 622

ORGANIZATION Punch Press Dept. No. 2 NO. 6338 ACCTG. LOADING CLASS 622

SUMMARY OF NORMAL EXPENSE FOR PRODUCTIVE LOADING UNITS
(THE EXPENSES INSERTED BELOW REPRESENT THE AVERAGE FOR ALL MACHINES IN CLASS AND THE TOTAL FOR BENCH WORK OPERATIONS)

DESCRIPTION OF LOADING CLASS No. 19 Inclinable Power Punch Press and No. 2 Power Punch Press.

MAKER'S NAME

NUMBER OF MACHINES IN CLASS 72

	NORMAL ANNUAL EXPENSE
1. MACHINERY	
DEPRECIATION: FIRE PROTECTION (INCL. INSURANCE), & TAXES—FACE VALUE $ 294 ANNUAL RATE 104	$ 31.00
CHANGES	9.00
REPAIRS	250.00
2. TOOLS	
DEPRECIATION: SMALL TOOLS	$ 241600
EXPENSE TOOLS	100
CHANGES	227.00
REPAIRS	884.00
FIRE PROTECTION (INCL. INSURANCE): DEPRECIATION $ 2,416 ANNUAL RATE $ .01376	33.00
TAXES: DEPRECIATION $ 2,416 ANNUAL RATE $ .00442	11.00
TOOL STOCKKEEPING (PRODUCTION BRANCH): DEPRECIATION $ 2,416 ANNUAL RATE .00988	24.00
3. FIXTURES	
DEPRECIATION	$
CHANGES	
REPAIRS	
FIRE PROTECTION (INCL. INSURANCE): DEPRECIATION $ ANNUAL RATE $	
TAXES: DEPRECIATION $ ANNUAL RATE $	
4. SUNDRY EXPENSE	
WAGES	$ 126.00
EXPENSE SUPPLIES INCL. SUPPLY STOCKKEEPING	10.00
EXPERIMENT, DESIGN AND EXPERIENCE	21.00
OTHER Defective Work and Errors	4.00
Moving and Handling Shop Equipment	11.00

5. SERVICES FROM PLANT DEPARTMENTS

	UNIT CONSUMPTION PER HOUR		NORMAL HOURS	TOTAL UNITS	STD. RATE	PER	
ELECTRICAL POWER: DISTRIBUTED	40	K.W.	380	154	.014	K.W.H.	$ 2.00
TRANSMITTED	40	K.W.	940	376	.022	K.W.H.	8.00
STEAM		LBS.				M. LBS.	—
COMPRESSED AIR	150	CU. FT.	1320	198050	.041	M. CU. FT.	9.00
COMPRESSED AIR FOR CLEANING		CU. FT.				M. CU. FT.	
GAS "For cleaning Machines"		CU. FT.				M. CU. FT.	
OIL		GAL.				GAL.	
WATER		CU. FT.				M. CU. FT.	
RENT: AREA 54 SQUARE FEET. ANNUAL RATE $ .66							35.00
ATTENDANTS							
OTHER 72x8/72 Total of all Service units							

6. ASSESSMENTS FROM AUXILIARY UNITS (BROUGHT FORWARD FROM SHEET 2) No. of Machines (72) $ 8.00

7. TOTAL EXPENSE DIRECTLY APPLICABLE TO THIS LOADING CLASS $ 4120.00

FIG. 45.

This machine class appears on all records of that particular machine. For instance, when the machine is repaired, the time is charged against that machine class on the order. When the machine is moved from one

location to another, this machine class number identifies that machine, not only for the purpose of moving it but also to keep the records in the office straightened out for investment and other purposes. Each hour

DEPT. LOADING CLASS 622

ORGANIZATION Punch Press Dept. No. 2 NO. 6338 ACCTG. LOADING CLASS 622

SUMMARY OF NORMAL EXPENSE FOR PRODUCTIVE LOADING UNITS
(THE EXPENSES INSERTED BELOW REPRESENT THE AVERAGE FOR ALL MACHINES IN CLASS AND THE TOTAL FOR BENCH WORK OPERATIONS)

DESCRIPTION OF LOADING CLASS No. 19 Inclinable Power Punch Press and No 2 Power Punch Press

MAKER'S NAME

NUMBER OF ~~HEADS~~ MACHINES ~~BENCH POSITIONS~~ IN CLASS 72

8. ADMINISTRATION AND OTHER BRANCH EXPENSES ~~HEAD~~ MACHINE PER ~~LABOR~~ HOUR	
GENERAL ADMINISTRATION	.015
DEPARTMENTAL SUPERVISION	.066
OTHER BRANCH EXPENSE	.394
CLERICAL BRANCH	
INDUSTRIAL REL. BRANCH	
PRODUCTION BRANCH	
OPERATING BRANCH	
TECH. BRANCH-EXCEPT PLANT	
DEVELOPMENT BRANCH (EXCL. ACCT. 992)	
INSPECTION BRANCH	
TECH. BRANCH—PLANT	
ACCT. 991	
TOTAL OTHER BRANCH	
TOTAL RATE PER HOUR	.475

NORMAL ANNUAL HOURS OF OPERATION Machine					1320	
MACHINE RATE PER HOUR					$ 3.11	
NO. OF MACHINES, HEADS OR FRACTIONS OF MACHINE RUN BY ONE OPERATOR						
MACHINE RATE PER HOUR	$ 3.110				$	¢
ADMINISTRATION AND OTHER BRANCH RATE PER HOUR	.475					
INDETERMINATE LOSSES						
LOADING RATE PER HOUR	3.585					
ACCT. 992 DEVEL. EXPENSE						
TOTAL RATE						
USE RATE PER HOUR	3.60					

NOTES:

ASSESSMENTS FROM AUXILIARY UNITS
BROUGHT FORWARD FROM H.W. 301-B

ACCTG. LOAD'G CL.	DESCRIPTION	AMOUNT
	TOTAL	

PRELIMINARY APPROVALS—
FIGURED BY
CHIEF OF SECTION
CHIEF OF DEPARTMENT
CHIEF OF SUB-DIVISION
CHIEF OF DIVISION
FINAL APPROVAL:

ASSISTANT CLERICAL SUPERINTENDENT

FIG. 46.

this machine is operated is turned in on time tickets against some specific order number, such as the manufacture of desk stand base plates. The number of hours of operation of *each machine class* is also reported weekly on a machine-activity report which shows the relation of the

hours worked to the standard hours and also to the *capacity hours*. As you will see later on, the standard hours become one of the fundamental parts in determining our standard loading rates.

On this same sheet of paper, of which we spoke before, the headings across the top are lined up to show all of the machine classes in the particular department in question. When the form is lined up in this manner, it next becomes necessary to distribute each item of expense, as shown in the left-hand column, to each of the machine classes, as shown for the columns to the right. Such items as *depreciation, insurance, fire protection, and taxes are distributed over each machine* class upon the basis of the face value of the machines in that class. The repairs to machines for each class are taken from orders on which the work was charged, the orders in each case showing the machine class of the machines repaired. Changes are distributed upon an estimate basis. Changes are made so infrequently that it is possible for the foremen to give us a very reasonable distribution of this class of expense over the machines in his organization.

Other items of expense are gone through in detail, each classification being given its proper consideration.

We use a very accurate method for distributing our charges for power. The power is *distributed to each machine on the basis of the amount of power consumed by that machine under averaged working conditions.* We determine the amount consumed *by actual meter tests.* This does not mean that we have a meter on each and every one of our machines; what we do is this: We have an electrician and an engineer insert a set of instruments in the feed line to each class of machines and determine the amount of power consumed under average working conditions. This takes into consideration the *time running idle, the starting load,* and the *running load.* These records are compiled in regular form and are used as a basis for distributing charges for power until such time as changes are made in the machine when it is necessary to make new tests and arrive at new units.

The *consumption of steam* is also determined by an engineer by inserting a *temporary valve in the return pipe* and *weighing the water condensed.*

Such items as gas, compressed air, and water are determined in a similar manner.

Rent is spread over each machine class on the basis of the *square feet of floor space occupied, giving ample allowance for proper working space.*

After all of the expenses have been distributed to each machine class, our next operation is to divide the *standard expense* by the *standard hours of operation* which gives us a *standard rate per hour for operating that particular class of machines.* For practical purposes this rate is rounded off to an even number of cents for all rates above 5 cents per hour. These rates are then applied in costs to all of the hours turned in by that machine class. The extension of the hours worked by the

rates in force gives us our loading returns, which are not only used for cost purposes in determining the standard shop cost of specific orders, but they are also used for statistical purposes. *The amount of these*

ORGANIZATION Light Punch Press Dept NO 6338 ACCTG LOADING CLASS N.P.

SUMMARY OF NORMAL EXPENSE FOR AUXILIARY LOADING UNITS
(THE EXPENSES INSERTED BELOW REPRESENT THE TOTAL FOR ALL MACHINES IN CLASS)

DESCRIPTION OF LOADING CLASS Steam Tables for Press 622

MAKER'S NAME

NUMBER OF MACHINES IN CLASS 8

								NORMAL ANNUAL EXPENSE
1. MACHINERY								
DEPRECIATION: FIRE PROTECTION (INCL. INSURANCE), & TAXES—FACE VALUE $ 182							ANNUAL RATE 10.4%	$ 19.00
CHANGES								
REPAIRS								13.00
2. TOOLS								
DEPRECIATION: SMALL TOOLS								
EXPENSE TOOLS								
CHANGES								
REPAIRS								
FIRE PROTECTION (INCL. INSURANCE): DEPRECIATION $							ANNUAL RATE $	
TAXES: DEPRECIATION $							ANNUAL RATE $	
TOOL STOCKKEEPING (PRODUCTION BRANCH): DEPRECIATION $							ANNUAL RATE $	
3. FIXTURES								
DEPRECIATION								
CHANGES								
REPAIRS								
FIRE PROTECTION (INCL. INSURANCE): DEPRECIATION $							ANNUAL RATE $	
TAXES: DEPRECIATION $							ANNUAL RATE $	
4. SUNDRY EXPENSE								
WAGES								
EXPENSE SUPPLIES INCL. SUPPLY STOCKKEEPING								
EXPERIMENT, DESIGN AND EXPERIENCE								
OTHER								
5. SERVICES FROM PLANT DEPARTMENTS	UNIT CONSUMPTION PER HOUR		NORMAL HOURS	TOTAL UNITS	STD. RATE	PER		
ELECTRICAL POWER: DISTRIBUTED		K.W.				K.W.H.		
TRANSMITTED		K.W.				K.W.H.		
STEAM	37	LBS.	2640	97680	41	M. LBS.		40.00
COMPRESSED AIR		CU. FT.				M. CU. FT.		
COMPRESSED AIR FOR CLEANING		CU. FT.				M. CU. FT.		
GAS		CU. FT.				M. CU. FT.		
OIL		GAL.				GAL.		
WATER		CU. FT.				M. CU. FT.		
RENT: AREA SQUARE FEET, ANNUAL RATE $								
ATTENDANTS								
OTHER								
6. TOTAL EXPENSE DIRECTLY APPLICABLE TO THIS EQUIPMENT								$ 72.00

FIG. 47.

returns represents the amount of expense which we are charging on jobs. A comparison of these figures with the actual expenditures for the month will determine whether or not our expenditures are higher or lower than our loading returns. If the actual expenditures are higher, it shows

that we are operating the shop at a loss; if they are lower, it shows that we are operating the shop at a profit. Perhaps, most important of all,

ORGANIZATION Light Punch Press Dept No. 6338 ACCTG. LOADING CLASS N.P.

SUMMARY OF NORMAL EXPENSE FOR AUXILIARY LOADING UNITS
(THE EXPENSES INSERTED BELOW REPRESENT THE TOTAL FOR ALL MACHINES IN CLASS)

DESCRIPTION OF LOADING CLASS Steam Tables for Press 622

MAKER'S NAME

NUMBER OF MACHINES IN CLASS 8

7 DISTRIBUTION OF TOTAL EXPENSE, BY PRODUCTIVE MACHINES AND BENCH OPERATIONS

NORMAL ANNUAL MACHINE HOURS OF OPERATION

ACCTG. LOADING CLASS	PER CENT	AMOUNT
622	100	$72
TOTAL	100	$72

NOTES

PRELIMINARY APPROVALS:—

FIGURED BY

CHIEF OF SECTION

CHIEF OF DEPARTMENT

CHIEF OF SUB-DIVISION

FINAL APPROVAL

WORKS ACCOUNTANT

FIG. 48.

it gives us a monthly check on the accuracy of the rates as a whole. A comparison of the actual returns from loadings with the normal returns from loadings furnishes an accurate index to the activity of the whole shop.

When it is necessary to determine the actual cost for a given order, it is necessary to take into consideration the difference between the actual expenditures and the loading returns. This is done by what we call a "current variation," the current variation in this case being the relation of the excess of actual expenditures to the loading returns; in other words, if the excess expenditures for the month are 10% greater than the loading returns for the month, 10% is added to loading returns on the order to bring them up to current cost.

Many perplexing difficulties will be encountered when first installing this system of loading rates in a large manufacturing organization. For this reason, I will show you herewith a few charts showing some of the plans for simplifying the compilations of various data required.

The first operation requires the classifying of all the machinery, first between that which is productive and that which is non-productive or auxiliary, for instance, a punch press blanking out hard-rubber parts will chip out too many of the parts unless the hard rubber is first heated to a certain extent. This is usually done on a steam table and in our system of figuring loading rates we apply the expense of the steam table, which is classified as non-productive or auxiliary equipment, to the punch presses which blank out the parts heated. (See Figs. 47 and 48.) After the machines are all classified, they are numbered and a permanent number plate attached to them to insure their future identity.

Loading rates need not be figured for each individual machine. It is more practical to *combine similar types of machines*, such as all of the No. 1 and No. 2 Brown and Sharpe screw machines and all of the No. 5 and No. 6 Brown and Sharpe screw machines. Records must be available by these machine classes so that the investment in each machine class may be known. Another great help is a layout showing the machines and the area occupied by such class. Records of the machine activity must be available for each machine class for the purpose of establishing standard hours for each class of machines. The power consumed by each machine should be available. Expense classifications must be established which will enable the ready compilation of expense figures by departments. Where expenses have not been properly divided for previous years, it may be necessary to estimate them to the best of your ability and out of this condition establish normal expense figures, such as we spoke of when we talked of how the budget was established. The *first set-up of normal expenses* should be *based upon as long a period* as it is possible to obtain, so that the unusual or abnormal conditions will be minimized. *Loading rates established* on this basis need not be changed for a period of 4 *or* 5 *years*. If the loading rates are properly established, they will be adequate for this length of time, but when first establishing them it would probably be advisable to revise them after *the second year*, when those working with the figures have become more familiar with the results expected.[1]

[1] From a talk given by Mr. J. H. Scott.

Method of Assigning Machine Class Numbers.

1. Take a physical inventory of all machine equipment.

2. Divide the equipment between the different general machine operations, such as

1. Cutting
2. Heating
3. Drilling
4. Shaping
5. Surfacing
6. Pressure
7. Rotation
8. Insulation
9. Miscellaneous

3. Further divide each general class by subclassifications; for example, 4, above.

4. Shaping:
   0. Universal bench and hand-milling machines
   1. Plain milling machines
   2. Horizontal milling machines
   3. Vertical milling machines
   4. Moulders and stickers

4. Further subdivide each subclassification; for example, 2, in preceding paragraph.

4-2. *Horizontal Milling Machines*

	Traverse inches	Transverse adjustment, inches	Vertical adjustment, inches	Weight of machines in pounds
0–Miscellaneous horizontal machines (Lincoln).....	20	19	8	1,475
1–Miscellaneous horizontal machines (Duplex No. 1, 2 head).....	14	14½	1⅞	1,275
2–Miscellaneous horizontal milling machines (2 head).....	48	19½	10½	4,200

5. Apply a serial number to each machine class in the order of purchase.

When a purchase requisition is placed for a new machine a number plate should be attached like this sample:

which decoded represents,

4	Shaping	—General classification
2	Horizontal milling	—Subclassification
1	Duplex No. 1, 2 head, Traverse 14 inches Transverse adjustment, $14\frac{1}{2}$ inches Vertical adjustment, $1\frac{7}{8}$ inches Weight of machine, 1,275 lb.	—Size
8	Serial number	—Indicating that this is the eighth machine of this size purchased.

How to Use Machine Rates.

While it is apparent that a large amount of work is required to set up a machine-rate system, its operation is simple, and in complex industries the accurate costs obtained by its use more than pay for the set-up costs. Quite a few companies have professional cost accountants come into their organization and work up the machine-rate method of distributing expense.

The page of a machine-rate book of an average size machine-tool plant is shown in Fig. 49. To illustrate the simplicity of operation let the following example be used.

Example: Machine used, Knight sensitive drill. Machine rate from Fig. 49 = $1.00
Length of time to perform job taken from the time cards, $8\frac{1}{2}$ hours.
Operator's rate $.60 per hour.
Direct material used on job, $2.50.

Cost of Job:

Direct Labor	$8.5 \times \$.60 =$	$ 5.10
Direct Material		2.50
Expense	$8.5 \times \$1.00 =$	8.50
Total Cost		$16.10

Evidently, then the computation of expense merely becomes a question of looking up the machine rate in a machine-rate book and multiplying that rate by the number of hours of machine operation. Clerks become very proficient at such work in a short time, and the average comptometer operator will not only extend the expense figures with lightning-like rapidity but in many cases will commit the actual machine-rate figures to memory.

Page of Machine Rate Book

Drilling Machines

	Department	Area	Date acquired	Cost	Horse-power	Machinery depreciation	Fixed Charges: Buildings, depreciation	Fixed Charges: Taxes	$.01395 per horse-power-hour power: Horse-power-hours	$.01395 per horse-power-hour power: Expense	$.0924 per square foot, heat and light	Machine hours	Machine, current expense	Total machine expense	Machine rate per hour
10. 656 Knight Sensitive	Bower	20	2-14-17	$ 75.00	¼										
11. 589 Davis	Weber	40	9-28-13	96.00	½										
	Total	60		$ 171.00	¾	$188.10	$ 7.24	$ 4.45	1,472.50	$20.54	$ 5.54	3,926.80	$3,706.78	$ 3,932.65	$1.00
11. 1164 Avey Single, No. 3	Marx	30	11- 8-24	$ 450.00	½										
11. 1165 Avey Single, No. 3	Bower	30	11- 3-24	450.00	½										
	Total	60		$ 900.00	1	99.00	7.24	4.45	1,963.40	27.39	5.54	3,926.80	3,706.78	3,850.40	.98
11. 1222 Edlund Two Spindle No. 2	Marx	40	3-29-25	$ 419.00	1										
	Total	40		$ 419.00	1	46.09	4.82	2.97	1,963.40	27.39	3.70	1,963.40	1,853.39	1,938.36	.99
11. 1166 Avey Two Spindle No. 3	Wilson	40	11- 8 24	$1,025.00	1										
11. 1191 Avey Two Spindle No. 2½	Wilson	40	1- 8-24	635.00	1										
11. 1192 Avey Two Spindle No. 2½	Weber	40	1- 8-24	635.00	1										
	Total	120		$2,295.00	3	252.45	14.48	8.91	5,890.20	82.17	11.09	5,890.20	5,560.18	5,929.28	1.01
11. 693 Cincinnati Radial, 4 feet	Marx	200	12- 2-17	$1,011.00	2										
11. 729 Cincinnati Radial, 4 feet	Marx	200	6-15-19	1,075.00	2										
11. 1220 American Radial, 4 feet	Marx	200	3-29-25	3,108.00	2										
	Total	600		$5,194.00	6	571.34	72.41	44.54	11,780.40	164.33	55.44	5,990.20	5,560.17	6,468.23	1.10
11. 945 Cincinnati Radial, 3½ feet	Wilson	100	11-23-22	$1,480.00	1										
11. 791 Fosdick Radial, 3½ feet	Wilson	100	2- 7-21	940.00	1										
11. 790 Fosdick Radial, 3 feet	Bower	100	2- 7-21	880.00	1										
11. 854 Fosdick Radial, 3 feet	Bower	100	8- 4-21	1,030.00	1										
11. 1230 Fosdick Radial, 3 feet	Bower	100	4- 3-25	2,027.45	1										
	Total	500	12- 7-22	$6,357.45	5	699.32	60.34	37.12	9,817.00	136.95	46.20	9,816.90	9,266.87	10,246.80	1.04
11. 1556 American H. S. Radial, 2½	Wilson	130	12- 7-22	$1,250.00	1½										
11. 1557 American H. S. Radial, 2½	Wilson	130	12- 7-22	1,250.00	1½										
	Total	260		$2,500.00	3	275.00	31.38	19.30	5,890.20	82.16	24.02	3,926.80	3,706.78	4,138.64	1.05

11. 731 Cincinnati Four Spindle No. 3	Weber	90	7–25–19	$ 660.00	1									
	Total	90		$ 660 00	1	72.60	10.86	6.68	1,963.40	27.39	8.32	1,963.40	1,853.39	1,979.24	1.01
11. 1062 Sipp 8 inches	Black	60	5– 2–24	399 00	1									
	Total	60		$ 399.00	1	43.89	7.24	4.46	1,963.40	27.39	5.54	1,963.40	1,853.39	1,941.91	.99
11. 243 Cincinnati 21 inches	Black	40	7–20–12	$ 170.00	½									
	Total	40		$ 170 00	½	18.70	4.83	2.97	981.70	13.69	3.70	1,963.40	1,853.39	1,897.28	.97
11. 776 Colburn Hy Duty No. 14	Marx	70	11–18–20	$ 758.00	1									
11. 777 Colburn Hy Duty No. 14	Black	70	11–18–20	710.00	1									
	Total	140		$1,468.00	2	161.48	16.90	10.39	3,926.80	54.78	12.94	3,926.80	3,706.78	3.963.27	1.01
11. 222 Foote-Burt 6 Spindle No. 15.	Weber	50	1910	$ 460.00	1½									
	Total	50		$ 460.00	1½	50.60	6.03	3.71	2,945.10	41.08	4.62	1,963.40	1,853.39	1,959.43	1.00
11. 856 Cincinnati Radial, 5 feet	Wilson	300	8– 7–21	$1,660.00	11½									
	Total	300		$1,660.00	11½	182.60	36.21	22.27	22,579.10	314.98	27.72	1,963.40	1,853.39	2,437.17	1.24

FIG. 49.

Normal Operation—Underabsorbed and Overabsorbed Factory Expense.

In all of the previous discussions, the idea of normal operation presented in Chap. XIII must not be overlooked. All expense should be allocated on the basis of a normal period. The following extract from the government bulletin "Overhead Expenses" previously referred to will further serve to enlighten the reader concerning the normal point of operation.

A Normal Year—the Business Standard.

Our cost systems are far too rigid. Under cost methods still largely in use overhead expenses are spread too thin in times of forced production and massed too heavily in periods of slight demand and production, giving in the former case, costs that are artifically low and unfair to the management, and in the latter case, costs that are artifically high and unfair to the public, and, moreover, costs which the market will not sustain.

For the sake of convenience, we split up our business into years and treat each year separately. On the basis of a fiscal year, we determine the profits for the period and distribute them to the stockholders accordingly. That is well and proper, but when it comes to the distribution of overhead expenses to our product cost for the purpose of making or gauging our selling prices it is desirable, in fact important, to select a longer period than one year, or, in fact, consider the actual overhead expenses and volume of business for several years.

Operation under a Normal-year Basis.

The determining of a normal year is not an easy matter. It requires a long look behind and a far look ahead. It is by no means sufficient to accept the operations of the preceding year as the sole standard. The normal year is different for a new organization or industry from what it is for one long established. Again, it is probably different next year than now because it should be expected that normal production will not remain on a dead level, but will probably curve upward with the growth of population and the demand for the product. To do otherwise would indicate industrial stagnation.

To establish normal unit overhead charges, two things must be determined:

1. Normal overhead expenses for the various departments of the business.
2. Normal production.

When the normal overhead expenses are divided by the normal production, the result is the normal unit overhead charge.

In determining normal overhead expenses, those expenses of the previous years which are accidental or very unusual should be eliminated. In the case of these, provision is usually made by creating a reserve directly from the surplus and known as a "Reserve for Contingencies." An effort must also be made reasonably to anticipate and allow for the trend of expenses for the coming year.

But there is nothing conclusive, final, or binding about this estimate of normal expenses. Each month your cost system should give the estimated overhead expenses and the actual expenses. If there is an increase of the actual over the estimated, and upon analysis that increase is found to be a real increase, due to unanticipated increase of salaries or insurance rates, etc., and not an inflation arising from reduced production, an adjustment upward can immediately be made in the unit overhead charges. Some concerns do this. Usually, however, it is feasible to establish a ratio of overhead expenses sufficiently close to the desired end that it is unnecessary to adjust the normal ratio prior to the end of the fiscal year. It is desirable from many points of view to leave undisturbed the normal ratio established at the beginning of the year until the year has closed. However, each concern will establish for itself a safety zone, below, or above which decreases or increases in real costs will be reflected and taken up in the selling price.

In determining normal production due allowance must be made for interruptions of operation. Even in the job industries, which by necessity have been schooled to base capacity on regularly operated machines. When these machines do not regularly operate, it is apt to go hard with the establishment. In a paper mill with a possible yearly operating time of 7,488 hours, the plant was idle 689 hours or not quite 10% of the time, because of the usual and customary interruptions from changing wires and felts, starting and stopping, repairs and high water. How transportation tie-ups, strikes, and slackened demand in many industries affect production is, of course, familiar to all. In determining normal production, then, do not delude yourself by placing it too high—at a mark reached only in exceptionally fortunate years.

Necessary Cost System Adjustments.

The accounting device used to secure operation on a basis of a normal year is the now familiar one of the Reserve, or a modification thereof.

For purposes of illustration, although the situation is not identical, let us recall how a simple reserve, such as the reserve for bad debts, operates. The operating account, "Bad Debts," is debited each month with the estimated amount of bad debts likely to be sustained on the sales of that month, and the account, "Reserve for Bad Debts," credited each month with a like amount. As bad debts are actually sustained, the amount thereof is debited to the Reserve for Bad Debts and credited to Accounts Receivable.

So the estimated normal overhead expenses will be charged into costs upon the particular cost method employed (man-hours, machine-hours, productive labor, etc.) and likewise credited to the Reserve for Overhead absorbed in costs. The actual overhead expense will be debited to the particular expense accounts, and closed out periodically to the Reserve for Overhead. Accordingly, the debit side of the Reserve for Overhead will give the actual expense totals, and the credit side the estimated expense. It is assumed such a reserve for overhead will be subdivided in accordance with departmental requirements, and, where convenient, the expenses will be scheduled.

This is the treatment, leaving out of consideration certain refinements used by some companies, that take into account such things as Underearned and Overearned Overhead or Burden, Overhead or Burden Variance, Supplemental Rates, etc. These do not disturb the essential principles set forth and are apt to confuse a simple presentation of them.

Concrete Illustrations of Underabsorbed and Overabsorbed Factory Expense.

Figure 50, a diagram suggested by N. T. Ficker in "Shop Expense Analysis and Control," clearly illustrates the operation

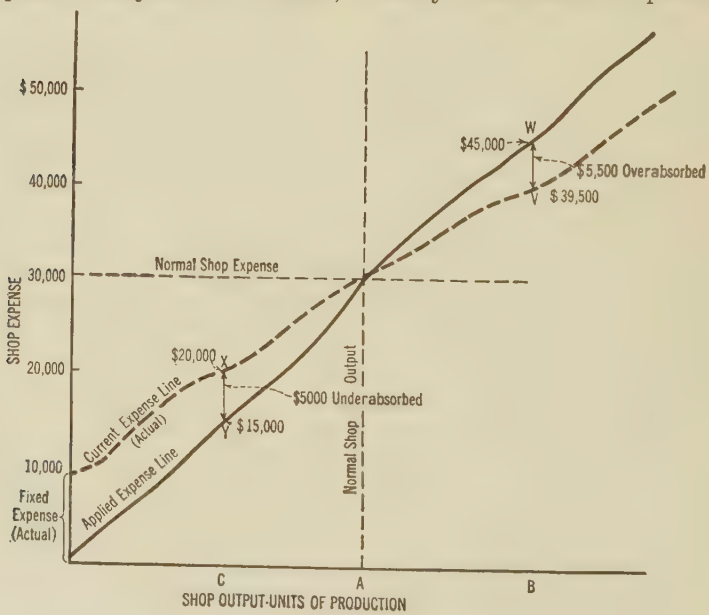


Fig. 50.

under normal shop output. The paths of these curves are difficult to estimate, some authors using straight lines and others

various forms of curves. Irrespective of the paths of these curves, this diagram illustrates the principle of underabsorbed and overabsorbed factory expense better than any known illustration.

If the shop operates at point A, all expenses will be distributed. An increase in the output of the shop causing the number of productive units to rise to point B causes an overabsorption of factory expense amounting to WV dollars. In the same manner, a slump in shop output, causing the number of units to fall to point C, causes an underabsorption of factory expense amounting to XY dollars.

A numerical illustration will be of further aid in presenting the important principle of operating at the point of normal shop capacity.

Problem 1.[1]

Case 1.—During a normal year, the total product of a factory making gear-cutting machinery was sold for $90,000. During this year about 20% of the machines were idle due to the impossibility of scheduling a continuous stream of work to all machines. In other words, it was not possible to keep all the machines busy all of the time. This is a condition to be expected in any plant working on the jobbing principle. These same conditions have prevailed for several years so that the directors of the company feel that this is a point of normal operation. The elements of cost and profits for the sale of $90,000 worth of gear-cutting machinery is shown below:

		Case 1
Direct Material	$10,000	
Direct Labor	32,000	
Factory Expense	30,000	
Total Factory Cost	$72,000	Point A, Fig. 50
Administrative and Selling Expense	8,000	Normal operation 100%
		Normal Shop Capacity
Cost to Make and Sell	$80,000	
Selling Price	90,000	
Profit	$10,000	

Case 2.—A year of brisk business follows, and the company makes and sells 50% more product than in Case 1. The product is sold at a cost of $102,500. The elements of cost and profits for this sale are shown on page 264.

[1] See KENT, W., "Bookkeeping and Cost Accounting for Factories."

Direct Material	$ 15,000	
Direct Labor	48,000	Case 2
Factory Expense	39,500[1]	Point *B*, Fig. 50
Total Factory Cost	$102,500	150 % of normal shop capacity
Administrative and Selling Expense	8,000	
Cost to Make and Sell	$110,500	
Selling Price	135,000	
Profit	$ 24,500	

[1] In spite of the 50 % increase in production the expenses of operation have been held down to $39,500.

Case 3.—Owing to the expiration of several important patents and the invention of a new method of cutting special gears, by a rival firm, the output of the factory drops to 50 % of its normal operation, and the product is sold for $45,000. The cost elements under this condition are:

Direct Material	$ 5,000	
Direct Labor	16,000	Case 3
Factory Expense	20,000[2]	Point *C*, Fig. 50
Total Factory Cost	$41,000	50 % of normal shop capacity
Administrative and Selling Expense	8,000	
Cost to Make and Sell	$49,000	
Selling Price	45,000	
Loss	$ 4,000	

[2] In spite of the fact that the shop operated only at one-half capacity, fixed charges, nevertheless, made it impossible to cut the factory expense below $20,000.

But such figures do not represent true costs.

In Cases 1, 2, and 3 the actual factory expenses were given, namely, $30,000, $39,500, and $20,000, respectively. If these were converted to a normal basis they would appear as

Case 1	$30,000 × 100 %	$30,000*
Case 2	$30,000 × 150 %	$45,000†
Case 3	$30,000 × 50 %	$15,000‡

For reference (* † ‡) see table, page 265.

Reference to Fig. 50 will give us a clearer picture. The gain, in case 2, of $45,000 − $39,500 = $5,500 is due to running the factory overtime, or possibly putting on more machine operators. It represents a gain in over-absorbed expense due to operating beyond the point of normal operation.

The loss in Case 3 of $20,000 − $15,000 = $5,000 represents an under-absorbed expense loss due to one-half the factory being idle.

The table which follows will give an idea of the values under the system of normal operation.

	Normal shop capacity, 100 %	150 % normal shop capacity	50 % normal shop capacity
	Case 1	Case 2	Case 3
Direct Material	$10,000	$ 15,000	$ 5,000
Direct Labor	32,000	48,000	16,000
Factory Expense	30,000(*)	45,000(†)	15,000(‡)
Total Factory Cost	$72,000	$108,000	36,000
Administrative and Selling Expense	8,000	8,000	8,000
Cost to Make and Sell	$80,000	$116,000	$44,000
Selling Price	90,000	135,000	45,000
Profit	$10,000	$ 19,000	$ 1,000

NOTE.—$5,000 of the Net Loss is due to underabsorbed Factory Expense due to 50 % of the factory being idle.

Profit based on normal operation would be

$$\$5,000 - \$4,000 = \$1,000$$

on the books the accounts would appear as shown on pp. 266 to 267.

Over a period of years underabsorbed and overabsorbed expense balances will tend to equalize one another. If the expense balances were carried into an underabsorbed and overabsorbed expense account, it would be shown as follows:

Underabsorbed and Overabsorbed Factory Expense

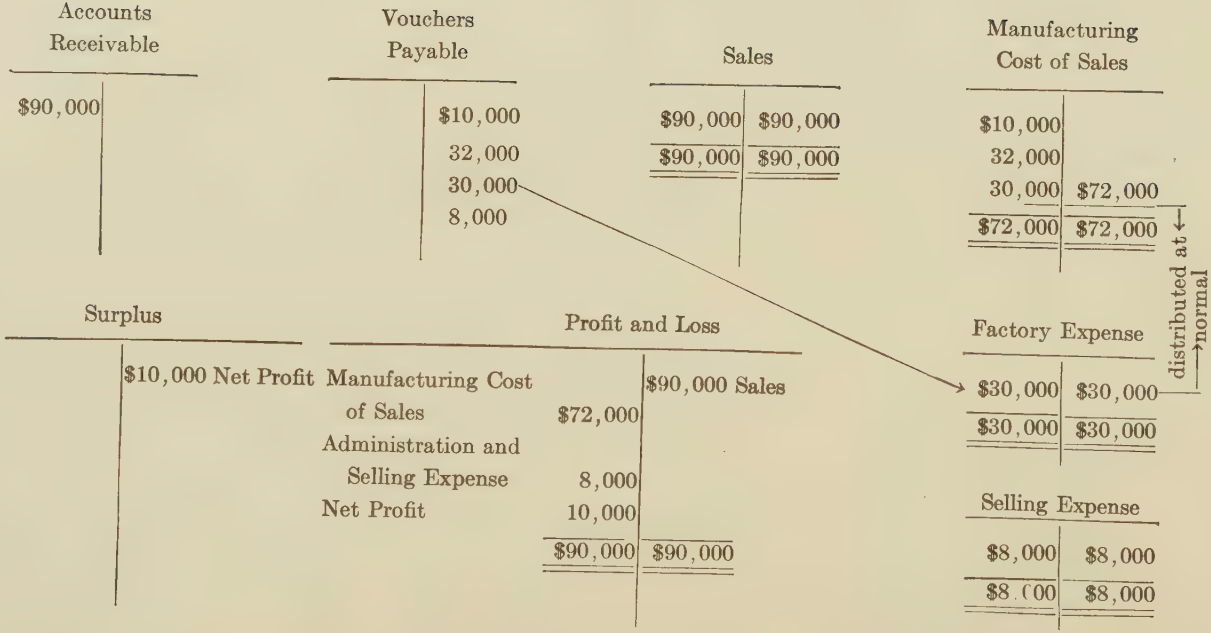
		Case I, all expense distributed	
Underabsorbed Case III	$5,000	$5,500 overabsorbed Case II	
To Profit and Loss	500		
	$5,500	$5,500	

Profit and Loss

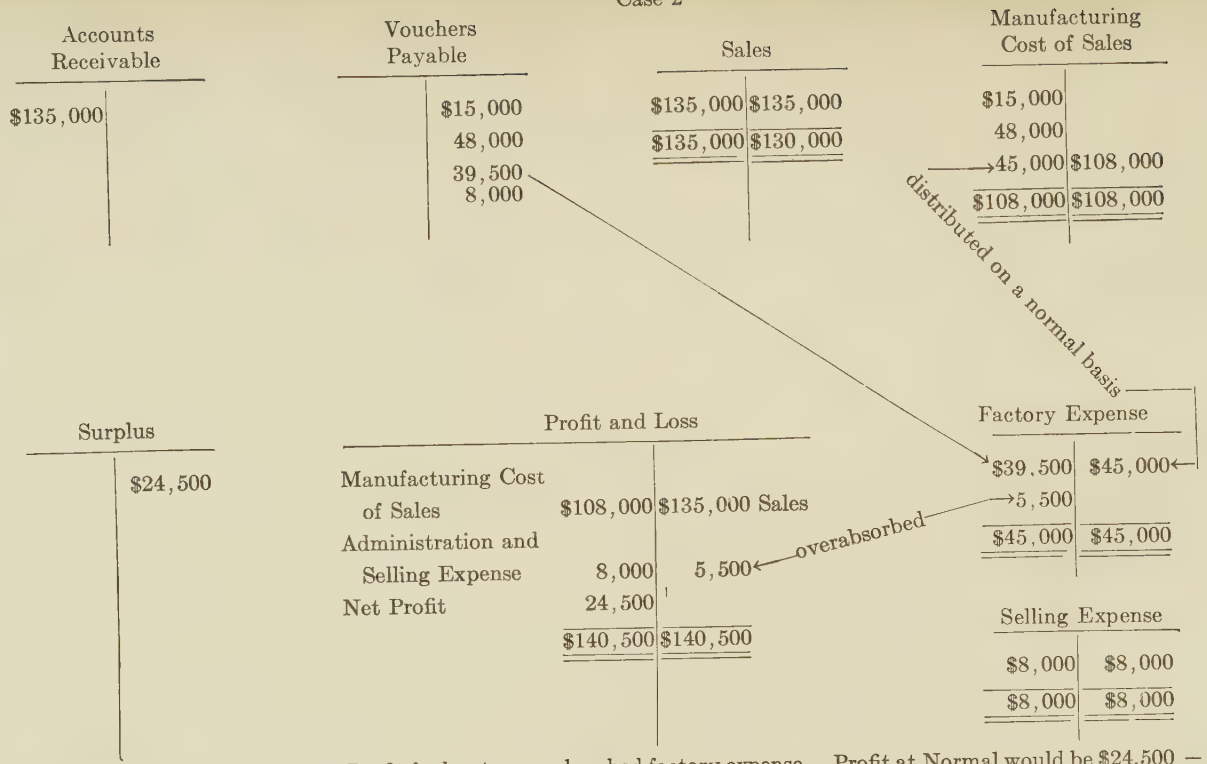
	$500 Profit

In this way the prosperous years of business activity may help to carry the lean years.

Case 1


Accounts Receivable
$90,000
Vouchers Payable
$10,000
32,000
30,000
8,000
Sales
$90,000 $90,000
$90,000 $90,000
Manufacturing Cost of Sales
$10,000
32,000
30,000 $72,000
$72,000 $72,000
distributed at normal
Surplus
$10,000 Net Profit
Profit and Loss
Manufacturing Cost of Sales $72,000
Administration and Selling Expense 8,000
Net Profit 10,000
$90,000 $90,000
$90,000 Sales
Factory Expense
$30,000 $30,000
$30,000 $30,000
Selling Expense
$8,000 $8,000
$8,000 $8,000

Case 2



NOTE.—$5,500 of the Net Profit is due to overabsorbed factory expense. Profit at Normal would be $24,500 − $5,500 = $19,000 (see page 265).

The diagram for Case 3 is not shown. It is similar to Case 2 except that there is a net loss of $4,000. This is due to under absorbed factory expense of $5,000. Based on normal operation there would be a profit of $5,000 − $4,000 = $1,000 (see page 265).

Loss Due to Idle Plant Capacity.

The foregoing discussion on normal operation brings to mind the significance of the loss due to idle plant capacity. Industrial executives must closely watch this rather inapparent form of loss and aim to keep their industries near the point of normal operation. The following problem on a transmission factory illustrates clearly the losses incurred due to idleness and also probable ways of overcoming them. *Idle plant loss* is made a special point of issue in presenting these statements.

Problem 2. To Illustrate Loss Due to Idle Plant Capacity.[1]

1. A factory manufacturing automobile transmissions has a normal capacity of 10,000 transmissions per month.

2. A period of depression sets in and the sales figures drop to 4,000 transmissions per month. Sales price $45 per transmission.

3. Cost of sales per unit is:

Material	$22.35
Hardening	3.48
Labor	8.27
Variable burden	3.65
Fixed burden at normal	2.25

4. Sales and Administrative $10,000 per month.

5. Draw up a statement of Profit and Loss, for sale of 4,000 transmissions per month, showing clearly

   a. Net Profit or Loss on Sales.
   b. Net Profit or Loss due to overabsorbed or underabsorbed burden.

6. The general manager can secure the additional output of 6,000 transmissions at a sales price of $40 each, which as you see is the shop cost. Can he afford to take the order? Illustrate by a Profit and Loss statement.

7. If the sales price in Problem 6 were $38 instead of $40 (a loss of $2 per transmission), how would the Profit and Loss statement compare with that of Problem 5?

8. What is the lowest figure at which he can sell a transmission and still absorb some of the loss due to idle plant capacity?

   a. Based on 10,000 transmissions?
   b. Based on 4,000 transmissions at $45, and 6,000 transmissions at?

9. Discuss the desirability of selling a product at cost or below cost as is done in Problems 6 and 7.

[1] See DOHR, "Cost Accounting," p. 409.

STATEMENT OF PROFIT AND LOSS

For Period Ending Apr. 30, 19—
Capacity of Plant 10,000 Transmissions

Sales 4,000 Transmissions at $45		$180,000
Cost of Sales (Manufacturing):		
Materials per Transmission	$22.35	
Hardening per Transmission	3.48	
Labor per Transmission	8.27	
Variable Burden per Transmission	3.65	
Fixed Burden per Transmission	2.25	
Total Cost per Transmission	$40.00	
4,000 Transmissions at $40 = Total Factory Cost		$160,000
Gross Profit on Sales		20,000
Less Sales and Administrative		10,000
Net Profit on Sales		10,000
Loss Due to Idle Plant Capacity:		
6,000 at $2.25 (Fixed Burden)		13,500
Total Net Loss (1)		$ 3,500

STATEMENT OF PROFIT AND LOSS

For Period Ending Apr. 30, 19—
Capacity of Plant 10,000 Transmissions

Sales 4,000 Transmissions at $45	$180,000	
6,000 Transmissions at $40	240,000	
Total Sales		$420,000
Cost of Sales (Manufacturing):		
Materials per Transmission	$ 22.35	
Hardening per Transmission	3.48	
Labor per Transmission	8.27	
Variable Burden per Transmission	3.65	
Fixed Burden per Transmission	2.25	
Total Cost per Transmission	$ 40.00	
Total Factory Cost 10,000 at $40		$400,000
Gross Profit on Sales		$ 20,000
Less Sales and Administrative		10,000
Net Profit on Sales		$ 10,000
Loss Due to Idle Plant Capacity		None
Net Profit (2)		$ 10,000

As compared with a loss of $3,500 in (1)

STATEMENT OF PROFIT AND LOSS
For Period Ending Apr. 30, 19—
Capacity of Plant 10,000 Transmissions

Sales 4,000 Transmissions at $45	$180,000	
6,000 Transmissions at 38	228,000	
Total Sales		$408,000
Cost of Sales (Manufacturing):		
Materials per Transmission	$ 22.35	
Hardening per Transmission	3.48	
Labor per Transmission	8.27	
Variable Burden per Transmission	3.65	
Fixed Burden per Transmission	2.25	
Total Cost per Transmissoin	$40.00	
Total Factory Cost 10,000 at $40		$400,000
Gross Profit on Sales		$ 8,000
Less Sales and Administration		10,000
Net Loss on Sales		$ 2,000
Loss Due to Idle Plant		None
Net Loss (3)		$ 2,000

As compared with a loss of $3,500 in (1)

First Assumption

To find break-even point
Based on 10,000
If sold at a loss of greater than $2.25 on manufacturing cost no fixed burden will be absorbed.

Add $1 for Sale and Administrative, $\frac{10,000}{10,000} = \$1$

$$(\$40 - \$2.25) + \$1 = \$38.75$$

Second Assumption

To find break-even point
Based on 4,000 at $45 and 6,000 at(?)

Manufacturing Cost, 10,000 at $40	$400,000
Sales and Administrative	10,000
Total Cost of Sales	$410,000
Sales of 4,000 at $45	180,000
Sales of 6,000 at(?)	$230,000

$$\text{Price} = \frac{230,000}{6,000} = \$38.33$$

The Economic Effect of Taking Business at or Below Cost. Is it good business to sell at or below normal cost? Many people contend that it hurts the market, it is unethical, and is

bad economy for the industry as a whole. Certainly, an article sold below cost establishes a bad precedent, and it may be hard to reëstablish its normal selling price. Such questions as these led to an investigation of this important problem by C. R. Stevenson of Stevenson, Harrison, and Jordon, and his findings, published in the 1927 Year Book of the National Association of Cost Accountants, is abstracted, in part, below.[1]

The survey consisted in sending out about 8,500 questionnaires to representative manufacturers all of whom rated $500,000 or better. Four questions were asked and the results of the questions with qualifications throw considerable light on this important subject.

Question 1. Do You Believe that Business Should Ever Be Taken at Normal Cost?

Of 696 returns on Question 1, 17, or 2%, did not reply to this particular question; 101, or 15%, replied Yes, but qualified their reply in some way; 262, or 38%, replied Yes without qualification; 21, or 3%, replied No with some qualification; 295, or 42%, *responded with unqualified No.*

Comments.

A wire manufacturer:

Yes: To maintain one's relative position by meeting existing levels. No: To take business away from competitors. When there is cut-throat competition, I believe it necessary to take business at or below cost, if there is anything to be gained over not taking it at all. Otherwise, I think the practice is unsound and silly. A reasonable profit should always be maintained unless you are not maintaining your percentage of existing consumption.

A bed manufacturer:

Your questions are very difficult to answer by Yes and No. The writer's own opinion of the question is that it is perfectly legitimate and often good business to sell goods without a profit through proper channels, but that the American habit of slashing the market as customary is indefensible. By proper channels, I mean, for instance, to jobbers who in their turn will sell to the retail merchant at a proper price that will not break the market.

[1] See Year Book, 1927, of National Association of Cost Accountants, pp. 21–90.

A leather goods manufacturer:

Only to close out dead lines.

Another manufacturer:

Yes, if overstocked.

A leather goods manufacturer:

We believe that taking business at cost is a very dangerous proposition, and that while there are certain times when taking business at, or even a trifle below cost, will give a temporary advantage, it almost always is lost later on. In our opinion, it is better to take an immediate loss than to postpone it by offering merchandise at cost.

Question 2. Do You Believe that Business Should Ever Be Taken below Normal Cost?

The 696 returns included 19, or 3%, who did not reply to Question 2; 62, or 9%, who gave a qualified Yes; 95, or 14%, who gave an unqualified Yes; 18, or 2%, who qualified No; and 502, *or 72% who responded with an unqualified No.*

Comments.

A machinery manufacturer says:

We do not believe in taking business below normal cost, but it is sometimes sound to take business below current cost figures if the cost of the additional volume thus secured is likely to reduce overhead sufficiently to bring the business into the profit-making class.

A pump manufacturer:

Yes, during temporary depressions.

A heavy machinery manufacturer:

Only under a temporary emergency and for a short period of time do I believe business should ever be taken below normal cost.

An elevator manufacturer:

We firmly and conscientiously believe that it is very seldom necessary to take a very extended volume of business below the normal costs. There may be times when one is in need of orders and when the burden is excessively high, that they would be justified in accepting business at a lower figure in order to keep volume steady, or increase same, but, generally speaking, we believe by carefully scrutinizing costs and watching the burden that it is very seldom necessary to go below a reasonable and normal cost.

A furniture manufacturer says:

Our opinion is that when a business reaches the point that it has to make its profit out of its overhead, it is in a precarious condition. This, of course, is predicated upon the assumption that the business has already kept its overhead to a minimum. In our opinion, it is much safer to maintain normal prices above a normal cost and do a restricted amount of business, than to attempt to absorb losses by increasing volume sufficient to squeeze a profit out of overhead.

Question 3. Do You Believe that the Theory of Incurring Losses by Taking Business at or below Normal Cost, with the Idea of Absorbing Overhead, Is Sound?

The 696 tabulated replies include 23, or 3%, who did not answer this question; 52, or 7%, who responded with a qualified Yes; 81, or 12%, who gave an unqualified Yes; 25, or 4%, who said No but qualified it; and 515, *or 74% of the total returns, who answered the question with an unqualified No.* This would seem to be a decidedly conclusive majority vote against the theory advanced in the question.

Comments.

A manufacturer of contractor's equipment:

Theoretically, No—practically, Yes, sometimes.

A manufacturer of springs:

We have answered that we believe that the theory of incurring losses by taking business below normal cost is sound, but we would not use the expression "incur loss." It is true one does not recover all his overhead, but he gains part, as against none, if he does not take the order. He only loses what he did not have but would like to have had.

A malleable-iron foundry says:

When business is taken below cost with the theory of getting a part of the overhead, the other fellow's overhead has been increased; consequently, the benefits have shifted from one to the other without any benefit to the industry as a whole, putting business on a very unsound basis.

A steel-casting company reports:

We know of one competitor who ran over 100% last year, thereby getting more than his share, and then found a loss of $85,000. He also helped to pull down the average sales price much lower than it should be, making it very difficult to bring it back.

Question 4. Do You Believe that the Financial Loss Incurred in Keeping Your Organization Intact, by Taking Business at or below Normal Cost, Benefits You in the Long Run?

Of the 696 returns, 31, or 4%, did not reply to this question; 65, or 9%, replied Yes with qualifications; 101, or 15%, said Yes; 18, or 3%, qualified their No; 469, *or* 69%, *gave an unqualified No as their reply.* While this is not quite so large a majority in the negative as on Question 3, nevertheless, it includes well over two-thirds of those who checked their questionnaires or otherwise replied to the question.

Comments.

A printing-ink manufacturer:

Yes. Unless your business only requires unskilled or untrained personnel. The organization is what produces profits in excess of ordinary interest. Normal operation should provide sufficient profit to assure reserves for these losses.

A manufacturer of electrical products:

Ordinarily, yes, provided the losses are not too severe. If business is slack and competition is keen, it is, in the writer's opinion, better to lose a little on sales than to lose a lot by disrupting your organization. Even this, however, has its limitations.

A malleable-castings foundry:

In regard to Question 4, there is little or no actual benefit in keeping organizations intact upon a low operating basis. In fact, I believe it to be a detriment to the business as the morale of the foremen and the men is greatly impaired and when there is an upward trend and operations are brought up to or above normal, it is sometimes necessary to replace a foreman, and even the better workmen, due to the lack of "pep" in order to equal previous records of performances. As a matter of fact, if during a period of dullness, wages are reduced even slightly or not at all, with the increase in business comes a demand for increase in wages. Therefore, from our experience we feel that the force of workmen should be trimmed to coördinate on an efficient basis with the value of output.

A manufacturer of pumps says:

We believe it is better, when business is poor, to keep your organization by closing down a day or two each week in order to meet existing conditions rather than to lay off employees indefinitely which would mean they would look for jobs elsewhere, and when business got normal, you would not be able to secure their services.

SUMMARY

In Chap. XIV, the following accounting points were emphasized:

1. The most widely used bases for distributing factory expense are (1) direct material, (2) direct labor, (3) man-hours, (4) machine rate.

2. The machine-rate method is the most scientifically accurate and the only one that will give true costs where a large variety of work is handled in the same plant.

3. The absorption of factory expense should be computed at a normal point of operation which is usually considered as 80% of full capacity.

4. Loss due to idle plant capacity, emphasizes the need for costs at a normal figure.

CHAPTER XV

FINANCIAL MATHEMATICS OR ACTUARIAL SCIENCE

OBJECT OF CHAPTER: To present in simple form, expressions for solving the major financial problems that arise in the managerial functions of an industrial enterprise.

FOUR FUNDAMENTALS UNDERLYING MAJORITY OF FINANCIAL CALCULATIONS

There are four fundamentals that underlie the majority of financial calculations. They are given below with explanations.

Fundamental 1. The amount of $1 for n Periods at i Rate of Interest.

This expression is the basis of all compound interest calculations. Knowing n and i, the total amount of interest and principal for $1 may be calculated. To illustrate, the amount of $1 for 5 years at 6% interest compounded annually is $1.3382. If the result is multiplied by any sum under consideration, the total amount of the interest and the principal may be obtained. In this work, all calculations are first made on the basis of $1 and the result multiplied by the sum being compounded.

Fundamental 2. The Present Value of $1 for n Periods at i Rate of Interest.

This value is the reciprocal of the amount of $1 for n periods at i rate of interest. In other words, how much money must be put at interest for n periods at i rate of interest to amount to $1? To illustrate, the present value of $1 for 5 years at 6% compounded annually is $.7473. This amount, if put at compound interest at 6% annually, will amount to $1 in 5 years.

Fundamental 3. The Amount of an Ordinary Annuity of $1 for n Periods at i Rate of Interest.

An ordinary annuity is the sum of a series of payments made at equal intervals of time and allowed to accumulate with

interest. Payments are made at the end of each period, no interest being allowed on the last payment. Interest payment on a bond and contributions to a sinking fund are common examples of the ordinary annuity. To illustrate, the amount of an annuity of \$1 for 5 years at 6% interest compounded annually is \$5.6371. Five dollars of this amount is accounted for by 5 contributions of \$1. The \$.6371 is the interest on the deposits.

Fundamental 4. The Present Value of an Ordinary Annuity of \$1 for n Periods at i Rate of Interest.

This means simply how much money must be deposited at the *present time* in order to withdraw a certain sum at equal intervals of time in the future. To illustrate, the present value of an

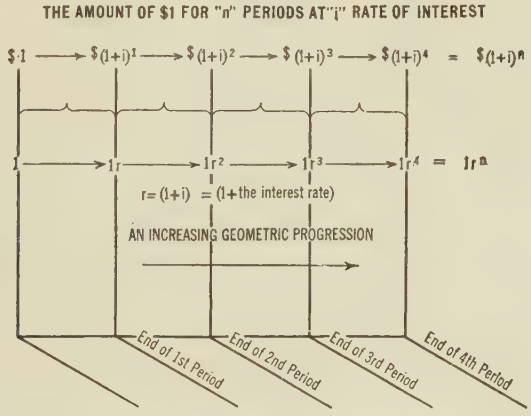


Fig. 51.

ordinary annuity of \$1 for 5 years at 6% interest, compounded annually, is \$4.2124. In other words, to withdraw \$1 at the end of each of 5 years it is necessary to deposit \$4.2124 at the present time.

ALGEBRAIC EXPRESSIONS OF THE FOUR FUNDAMENTALS

Fundamental 1.

These fundamentals may be diagrammatically presented and developed into simple and usable algebraic expressions.
The amount at the end of the first period $= (1 + i)$
The amount at the end of the second period $= (1 + i) + i(1 + i) = (1 + i)^2$

The amount at the end of the third period $= (1 + i)^2 + i(1 + i)^2 = (1 + i)^3$

The amount at the end of the fourth period $= (1 + i)^3 + i(1 + i)^3 = (1 + i)^4$

The amount at the end of the nth period $= (1 + i)^n$

As the preceding illustration shows, the amount of \$1 for n periods at i rate of interest is the last term of an increasing geometric progression, r being $(1 + i)$. The amount of \$1 for n periods at i rate of interest may then be expressed as,

$$\text{Amount} = a = (1 + i)^n. \quad \text{(See Fig. 51.)}$$

Problem 1.

Find the value of \$3,500 after 10 years at 5% interest compounded annually.

Solution.

$$a = (1 + .05)^{10} = 1.6288946.$$

(Solve by logarithms or read directly from Table I, page 293.)

Amount of \$3,500 = \$3,500 × 1.6288946 = \$5,701.13.

A very important principle must be taken note of at this point. Interest is usually compounded annually, semi-annually, or quarterly. Interest rates are usually stated in terms of 1 year, regardless of how frequently interest is added. The time is also customarily expressed in years. Mathematically, and for the use in formulæ, the time must be stated in a certain number of interest periods. To illustrate:

INTEREST COMPOUNDED ANNUALLY, SEMI-ANNUALLY, AND QUARTERLY

Annually...	1 interest payment	Number of periods 10 = (10 × 1)	Interest rate 5% (5/1)
Semi-annually	2 interest payment	Number of periods 20 = (10 × 2)	Interest rate 2.5% (5/2)
Quarterly.....	4 interest payment	Number of periods 40 = (10 × 4)	Interest rate 1.25% (5/4)

Compounded semi-annually, \$3,500 would amount to

$$a = (1 + .025)^{20} = \$1.6386164.$$

(Solve by logarithms or read directly from Table I, page 291.)

\$3,500 × \$1.6386164 = \$5,735.16 is equal to the amount of \$3,500 at 5% interest after 10 years compounded semiannually.

Compounded quarterly \$3,500 would amount to

$$a = (1 + .0125)^{40} = \$1.6436195.$$

(Solve by logarithms or read directly from Table I, page 290.)
$3,500 × $1.6436195 = $5,752.67 is equal to the amount of $3,500 at 5% interest after 10 years compounded quarterly.

Fundamental 2.

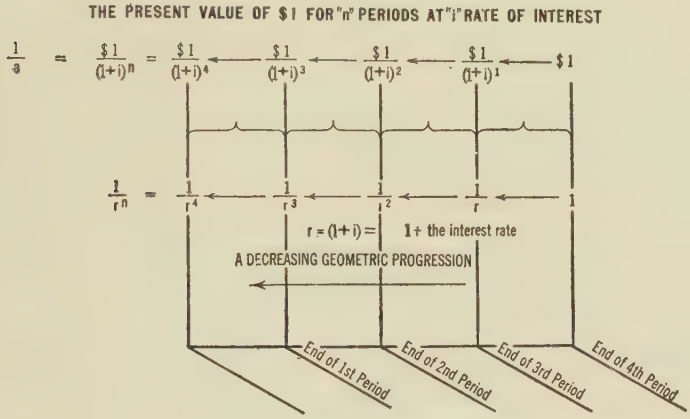

THE PRESENT VALUE OF $1 FOR "n" PERIODS AT "i" RATE OF INTEREST
$1
r = (1+i) = 1+ the interest rate
A DECREASING GEOMETRIC PROGRESSION
End of 1st Period
End of 2nd Period
End of 3rd Period
End of 4th Period

FIG. 52.

Present value at end of fourth period = 1

Present value at end of third period = $\frac{1}{1+i}$

Present value at end of second period =

$$\frac{1}{(1+i)+i(1+i)} = \frac{1}{(1+i)^2}$$

Present value at end of first period =

$$\frac{1}{(1+i)^2+i(1+i)^2} = \frac{1}{(1+i)^3}$$

Present value beginning of first period =

$$\frac{1}{(1+i)^3+i(1+i)^3} = \frac{1}{(1+i)^4}$$

Present value beginning of n periods = $\frac{1}{(1+i)^n}$

Figure 52 illustrates present value. It is essentially a discount proposition, it being required to find the amount of money at present which will, under certain interest conditions, produce a predetermined sum at a given date in the future.

Under these conditions, the principle of present value may be expressed as a decreasing geometric series, r being $(1 + i)$. The present value (P. V.) of \$1 for n periods at i rate of interest would then be equal to,

$$\text{P. V.} = \frac{1}{(1 + i)^n} = \frac{1}{a}.$$

The following problems illustrate the use of the P. V. principle.

Problem 2.

What sum invested at 5%, compounded annually, will equal \$3,000 in 8 years?

Solution.

$$\text{P. V.} = \frac{1}{(1 + i)^n} = \frac{1}{(1 + .05)^8} = .6768394.$$

(Solve by logarithms or read from Table II, page 297.)

$$\$3{,}000 \times .6768394 = \$2{,}030.52$$

If this sum were compounded semi-annually, the result would be,

$$\text{P. V.} = \frac{1}{(1 + .025)^{16}} = .6736249$$

$$\$3{,}000 \times .6736249 = \$2{,}020.87.$$

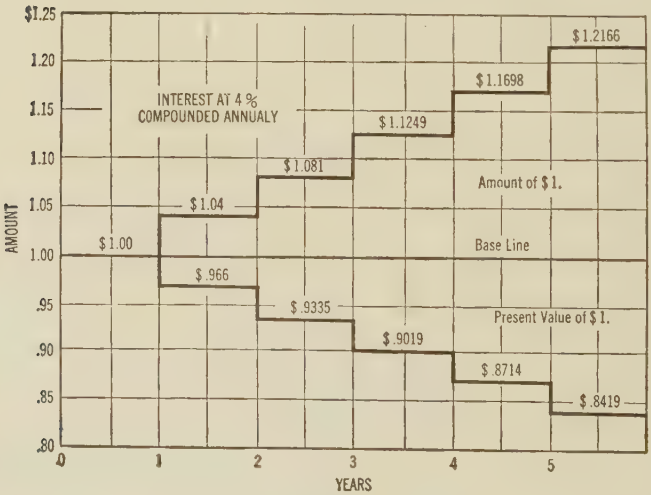


Fig. 53.

Figure 53 shows the comparison of A and P. V. using 4% interest compounded annually.

Fundamental 3.

Figure 54 shows that the amount of an ordinary annuity of \$1 for n periods at i rate of interest is the sum of a

geometric progression which may be calculated from the following formula:[1]

$$S = \frac{lr - a}{r - 1} = \text{Sum of a geometric progression} \qquad (1)$$

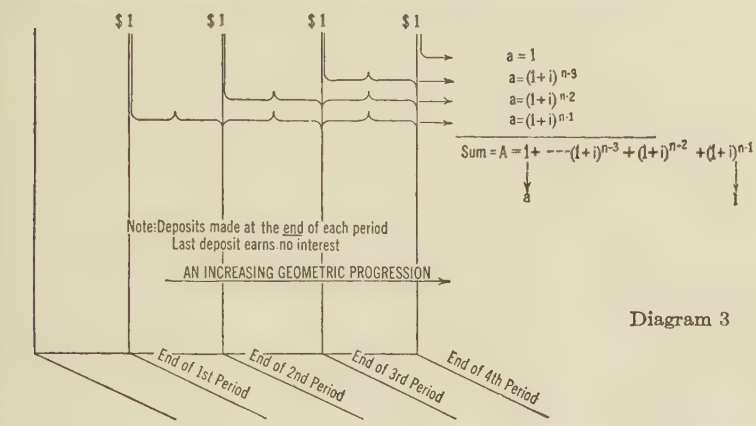

THE AMOUNT OF AN ORDINARY ANNUITY OF $1 FOR "n" PERIODS AT "i" RATE OF INTEREST
$1
$1
$1
$1
a = 1
a = (1+i)^n-3
a = (1+i)^n-2
a = (1+i)^n-1
Sum = A = 1+ ---(1+i)^n-3 + (1+i)^n-2 + (1+i)^n-1
a
l
Note: Deposits made at the end of each period
Last deposit earns no interest
AN INCREASING GEOMETRIC PROGRESSION
End of 1st Period
End of 2nd Period
End of 3rd Period
End of 4th Period

Diagram 3

FIG. 54.

where

l = the last term = $(1 + i)^{n-1}$, a = first term = 1, r = ratio = $(1 + i)$.

Making substitution in (1),

$$S = \frac{(1+i)^{n-1}(1+i) - 1}{1 + i - 1} = \frac{(1+i)^n - 1}{i}$$

A, then, the amount of an ordinary annuity of $1 for n periods at i rate of interest, may be expressed as

$$A = \frac{(1+i)^n - 1}{i}.$$

Up to this point, only single sums of money have been dealt with. In dealing with annuities, however, a series of payments to be made at some future time are evaluated. An ordinary annuity, as stated previously, is the sum of a series of payments made at the *end* of equal intervals of time and allowed to accumulate with interest. The sum is evaluated immediately following the last payment which as a result receives no interest.

(Other forms of annuity such as the annuity due, deferred annuity, etc. are based on calculating interest a period or more after the last payment is made.)

[1] TONER, J. V., "Mathematics of Finance," pp. 75–90.

Problem 3.

What will be the amount of an ordinary annuity of 30 payments of \$250 at 5%, compounded annually?

$$A = \frac{(1+i)^n - 1}{i} = \frac{(1 + .05)^{30} - 1}{.05} = 66.4388475$$

(Solve by logarithms or read directly from Table III, page 301.)

\$250 × 66.43884 = \$16,609.71 is equal to the amount of 30 payments of \$250 at 5% compounded annually.

Fundamental 4.

As in the preceding illustration, the sum may be found by substituting in the expression,

$$S = \frac{lr - a}{r - 1},$$

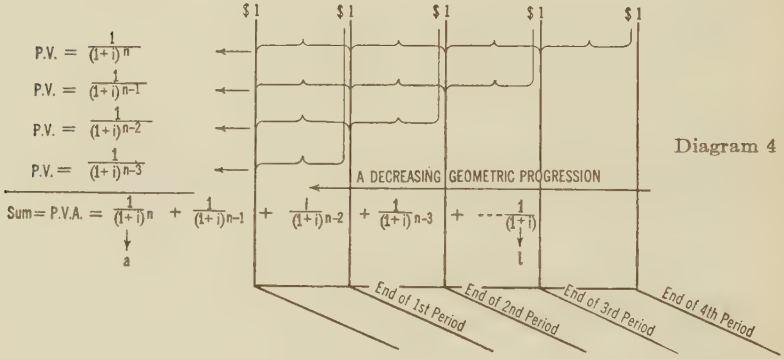


Diagram 4

FIG. 55.

where

$$l = \text{the last term} = \frac{1}{1+i}, \quad a = \text{first term} = \frac{1}{(1+i)^n},$$

$$r = \text{ratio} = (1+i).$$

The sum then will equal the P. V. A. or the present value of an ordinary annuity of \$1 for n periods at i rate of interest

$$S = \frac{\left(\frac{1}{1+i}\right)\left(\frac{1+i}{1}\right) - \frac{1}{(1+i)^n}}{1+i-1} = \frac{1 - \frac{1}{(1+i)^n}}{i},$$

or

$$\text{P. V. A.} = \frac{1 - \frac{1}{(1+i)^n}}{i}.$$

Problem 4.

What sum must be placed in a bank Jan. 1, 1928, at 4%, compounded annually, to enable the depositor to withdraw \$500 Dec. 31, 1928, \$500 Dec. 31, 1929, and \$500 Dec. 31, 1930?

Solution.

$$\text{P. V. A.} = \frac{1 - \frac{1}{(1 + .04)^3}}{.04} = 2.7750910.$$

(Solve by logarithms or read direct from Table IV, page 304.)

\$500 × 2.7750910 = \$1,387.55 is equal to the present value of \$500 under the conditions of the problem.

Sinking Funds.

Sinking funds are of ever-occuring importance to the industrial manager. He may be required to build up a specific sum of money to meet an obligation, or he may use this method of figuring depreciation.

A sinking fund is a sum of money being accumulated by periodic contributions, with interest, for some specific purpose, such as the payment of an obligation. The following diagram will show its development (see also Fig. 54):

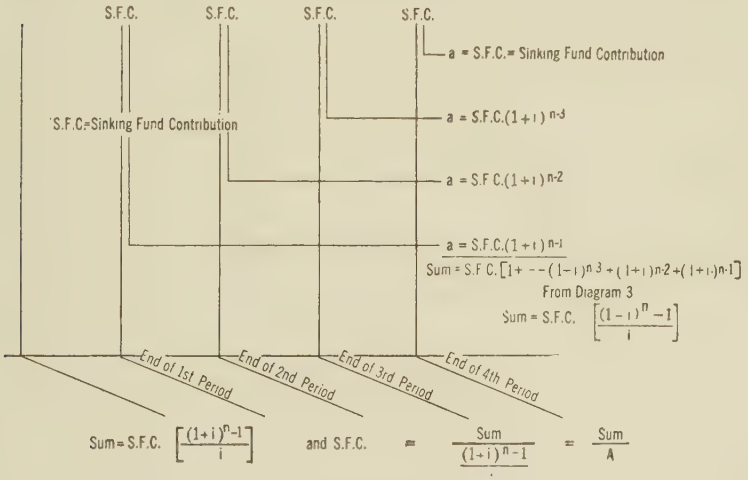

S.F.C.
S.F.C.
S.F.C.
S.F.C.
a = S.F.C.= Sinking Fund Contribution
S.F.C=Sinking Fund Contribution
a = S.F.C.(1+i) n-3
a = S.F.C.(1+i) n-2
a = S.F.C.(1+i) n-1
Sum = S.F.C. [1+ - -(1-i)n-3 +(1+i)n-2+(1+i)n-1]
From Diagram 3
Sum = S.F.C. [(1-i)n -1 / i]
End of 1st Period
End of 2nd Period
End of 3rd Period
End of 4th Period
Sum=S.F.C. [(1+i)n-1 / i]
and S.F.C. = Sum / (1+i)n-1 = Sum / A

Fig. 56.

Therefore, we may state the general expression,

Sinking fund contribution =

$$\frac{\text{Amount of fund to be accumulated}}{\text{Amount of annuity of \$1 for } n \text{ periods at } i \text{ rate of interest}}.$$

Hence, by merely finding the sinking fund value for \$1 (amount of an annuity of \$1 for n periods at i rate of interest), and dividing this into the fund to be accumulated, the sinking fund contribution may be obtained.

A problem will illustrate its simplicity.

Problem 5.

The Cartwright Axle Company mortgages its main building for \$15,000, the mortgage being due in 8 years. By paying a certain amount into a sinking fund, annually, and compounding this amount at 4%, the company expects to accumulate the \$15,000 at the end of the 8 years. What amount shall be set aside?

$$\text{Sinking fund contribution} = \frac{\$15{,}000}{\text{Amount of an annuity of \$1 for 8 periods at 4\%}}$$

$$= \frac{\$15{,}000}{9.2142263} = \$1{,}627.92.$$

SCHEDULE FOR SINKING FUND CONTRIBUTION TO ACCUMULATE A SINKING FUND OF \$15,000 IN 8 YEARS, INTEREST AT 4% COMPOUNDED ANNUALLY

Period	Sinking fund contribution	Interest accumulated on fund at 4%	Total increase for period	Amount of fund at end of period
1	\$ 1,627.92		\$ 1,627.92	\$ 1,627.92
2	1,627.92	\$ 65.12	1,693.04	3,320.96
3	1,627.92	132.84	1,760.76	5,081.72
4	1,627.92	203.27	1,831.19	6,912.91
5	1,627.92	276.52	1,904.44	8,817.35
6	1,627.92	352.69	1,980.61	10,797.96
7	1,627.92	431.92	2,059.84	12,857.80
8	1,627.92	514.31	2142.23	15,000.03
	\$13,023.36	\$1,976.67	\$15.000.03	

It is important to note that the sum of \$15,000 is outstanding during the entire period and interest must be paid upon it from the earnings of the business, usually at a *higher rate* than the sinking fund provides. The strong feature of the sinking fund is that when the obligation becomes due, cash is ready, usually in the hands of a trustee, to make full payment thereof.

Amortization of Interest-bearing Indebtedness.

The amortization of an interest-bearing indebtedness is the wiping out of an indebtedness, both principal and interest, by a series of equal periodic payments. When a periodic payment is made it includes interest on the balance of the principal and a partial reduction on the principal.

The most usual problem met in this connection is the determination of the amount to be paid periodically. This resolves itself into the problem of the present value of an annuity of n periods at i rate of interest (see Fig. 57 and Fig. 55).

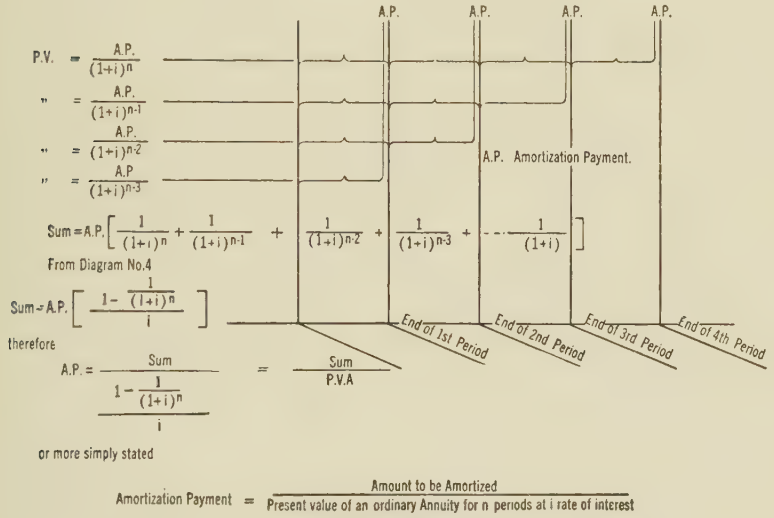

A.P.
A.P.
A.P.
A.P.
P.V. = A.P. / (1+i)^n
" = A.P. / (1+i)^n-1
" = A.P. / (1+i)^n-2
" = A.P / (1+i)^n-3
A.P. Amortization Payment.
Sum = A.P. [1/(1+i)^n + 1/(1+i)^n-1 + 1/(1+i)^n-2 + 1/(1+i)^n-3 + - - - 1/(1+i)]
From Diagram No.4
Sum = A.P. [(1 - 1/(1+i)^n) / i]
End of 1st Period
End of 2nd Period
End of 3rd Period
End of 4th Period
therefore
A.P. = Sum / ((1 - 1/(1+i)^n) / i) = Sum / P.V.A
or more simply stated
Amortization Payment = Amount to be Amortized / Present value of an ordinary Annuity for n periods at i rate of interest

FIG. 57.

Problem 6.

The Ronald Manufacturing Company negotiates a loan of \$50,000 at 6%, payable annually. They desire to cancel interest and principal in 10 payments. What will be the amount of the payments?

Solution.

$$\text{Amount of payment} = \frac{\text{Amount to be amortized}}{\text{P. V. A. of \$1 for 10 periods at 6\%}} = \frac{\$50{,}000}{7.3600870}$$

$$= \$6{,}793.40 \text{ amortization payment.}$$

SCHEDULE FOR THE AMORTIZATION OF AN INDEBTEDNESS OF $50,000 IN 10 YEARS WITH INTEREST AT 6%, COMPOUNDED ANNUALLY

Period	Amortization payment	Interest on remainder of indebtedness at 6%	Net reduction of indebtedness	Balance of indebtedness
				$50,000.00
1	$ 6,793.40	$ 3,000.00	$ 3,793.40	46,206.60
2	6,793.40	2,772.40	4,021.00	42,185.60
3	6,793.40	2,531.14	4,262.26	37,923.34
4	6,793.40	2,275.40	4,518.00	33,405.34
5	6,793.40	2,004.32	4,789.08	28,616.26
6	6,793.40	1,716.98	5,076.42	23,539.84
7	6,793.40	1,412.39	5,381.01	18,158.83
8	6,793.40	1,089.53	5,703.87	12,454.96
9	6,793.40	747.30	6,046.10	6,408.86
10	6,793.40	384.53	6,408.87	
	$67,934.00	$17,933.99	$50,000.01	

Comparison of Sinking Fund and Amortization Plans.

There are many reasons why financiers may use one method or the other. If it were possible to get the same rate of interest in a sinking fund as it is necessary to pay upon borrowed capital or under an amortization plan, then there would be little to choose between the two plans so far as a financial saving is concerned.

Actually, this is rarely the case. Wise investment will usually limit the interest rate on a sinking fund to 4 or 5%, while the firm may find it necessary to pay from 6 to 7% from its earnings on the obligation.

The following illustration of the Breckley-Jones Company illustrates these points:

Problem 7.

The Breckley-Jones Company desires to accumulate $30,000 in 10 years to retire a mortgage on its buildings. It is considering the use of either a sinking fund or an amortization plan.

To compare the workings of the two plans two cases are given below.

Case 1.

Interest on sinking fund 6% compounded semi-annually.

Interest on mortgage 6% compounded semi-annually.

Interest on remainder of indebtedness under amortization plan 6% compounded semi-annually.

Solution to Case 1.

$$\text{Sinking fund contribution} = \frac{30{,}000}{A \text{ for \$1 for 20 periods at } 3\%} = \frac{30{,}000}{26.8703745} = \$1{,}116.47.$$

$$\text{Amortization payment} = \frac{30{,}000}{\text{P. V. A. for \$1 for 20 periods at } 3\%} = \frac{30{,}000}{14.8774749} = \$2{,}016.47.$$

Total payment under sinking fund plan,

Sum of sinking fund contributions	= \$1,116.47 × 20	= \$22,329.40
Interest on outstanding debt	= \$30,000 × .03 × 20	= 18,000.00
		\$40,329.40

Total payment under amortization plan,

Sum of amortization payments = \$2,016.47 × 20 = \$40,329.40.

The results under like interest conditions are the same. Such similarity of interest rates rarely occur, however. For the purposes of security, the sinking fund is usually allowed to accumulate at say 4% or 5%. Case 2 illustrates this plan.

Case 2.

Interest on sinking fund, 4%, compounded semi-annually, other data the same as in Case 1.

$$\text{Sinking fund contribution} = \frac{30{,}000}{A \text{ for \$1 for 20 periods at } 2\%} = \frac{30{,}000}{24.2973698} = \$1{,}234.70.$$

Total payment under sinking fund plan,

Sum of sinking fund contributions	= \$1,234.70 × 20	= \$24,694
Interest on outstanding debt	= \$30,000 × .03 × 20	= 18,000.
		\$42,694

Total payment under amortization plan from Case 1 = \$40,329.40.

Savings = \$42,694,00 − \$40,329.40 = \$2,364.60 by using amortization plan.

Bond Valuation.

The principles of actuarial science developed in the preceding pages find distinct application in the valuation of bonds. A bond is a promise to pay a specified sum at a specific date in the future and to pay interest on this sum at the rate and on the dates stated in the bond. As shown in the diagram (Fig. 58) a bond is made up of two promises, *i.e.* (1) The promise to pay the principal when the bond matures; and (2) the promise to pay the interest upon the principal on the specified dates until the bond matures. The component parts of a \$1,000, 6% bond maturing in 10 years with interest payable semi-annually are shown diagrammatically in Fig. 58.

Coupon Rate.

The coupon or bond rate of interest is the rate of interest specified on the bond. Such interest is usually paid semi-annually.

Current or Yield Rate.

When a bond is purchased, the buyer pays the present value of two rights; namely (1) the present value of the right to receive the principal at maturity and (2) the present value of the right to receive the periodic interest payments at the specified dates until the bond matures. In computing the value of these rights, the current or prevailing interest rate of this type of investment is used. A term very frequently used is "yield rate."

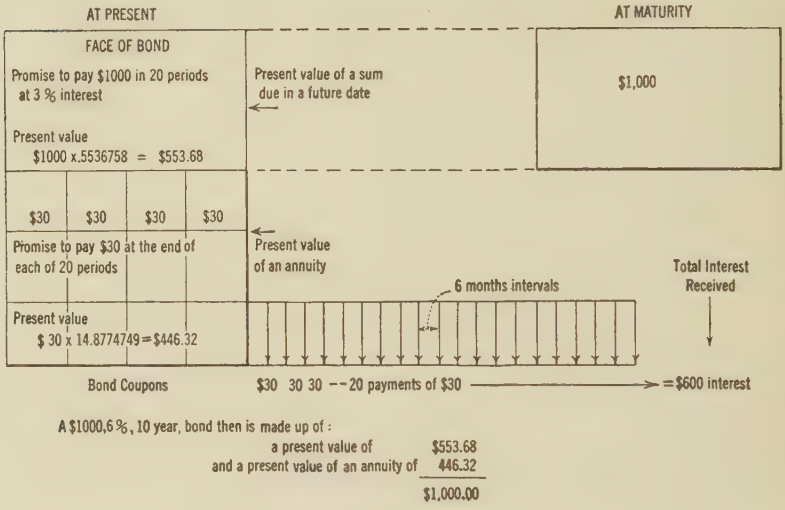

AT PRESENT
AT MATURITY
FACE OF BOND
Promise to pay $1000 in 20 periods at 3 % interest
Present value $1000 x.5536758 = $553.68
Present value of a sum due in a future date
$1,000
$30 $30 $30 $30
Promise to pay $30 at the end of each of 20 periods
Present value of an annuity
6 months intervals
Total Interest Received
Present value $ 30 x 14.8774749=$446.32
Bond Coupons
$30 30 30 --20 payments of $30
=$600 interest
A $1000,6 %, 10 year, bond then is made up of :
a present value of $553.68
and a present value of an annuity of 446.32
$1,000.00

Fig. 58.

The application of these principles will be illustrated by the following problems:

Application of Actuarial Principles to Bonds.

Problem 8. Bonds Bought at a Premium.

What price shall be paid for a 7%, 10-year, $1,000 bond, interest payable semi-annually to yield a 6% return on the money?

A consideration of the facts reveals:

1. That the face value of the bond will be returned to the holder at the end of 10 years.

2. That he will receive as holder of the bond $35 every 6 months during the run of the bond.

The points hinge on two fundamentals studied:

a. The present value of $1 for n periods at i rate of interest.

b. The present value of an annuity of $1 for n periods at i rate of interest.

In other words, find the present worth of the \$1,000 and the present value of the annuity of \$35 and add the two.

\$1,000 × .5536758 (P. V. of \$1 for 20 periods at 3%) =	\$ 553.68
\$35 × 14.8774749 (P. V. A. of \$1 for 20 periods at 3%) =	520.71
Amount to be paid for bond	\$1,074.39

Problem 9. Bond Bought at a Discount.

Suppose with the preceding illustration it was desired to obtain a yield of 8%. What amount should be paid for the bond?

\$1,000 × .4563870 (P. V. of \$1 for 20 periods at 4%) =	\$456.39
\$35 × 13.5903263 (P. V. A. of \$1 for 20 periods at 4%) =	475.66
Amount to be paid for bond	\$932.05

This procedure may be stated by means of an expression as follows: Amount to be paid for bond = (face value of bond) × (present value of \$1 for number of life periods of bond at desired yield rate) + (periodic interest payment on bond) × (present value of annuity of \$1 for number of life periods of bond at desired yield rate).

Shorter Method of Bond Valuation.

A somewhat shorter method may be used in solving Problems 8 and 9 by obtaining the present worth of the difference between the *coupon rate* and the *yield rate*. Thus, when the coupon rate and the yield rate are the same the bonds are at par. When the coupon rate is higher than the yield rate, bonds are sold at a premium, and when *vice-versa*, they are sold at a discount. The solution of Problems 8 and 9 will illustrate this procedure:

Problem 8.

\$1,000, 7%, 10-year bond to yield 6%

Value of bond at par	\$1,000.00
Plus present value of excess interest	
\$1,000 × .035 = \$35 Coupon rate	
\$1,000 × .03 = 30 Yield rate	
\$ 5	
Present value of 20 payments of \$5 at 3% = \$5 × 14.8774749 =	\$74.39
Value of bond	\$1,074.39

Problem 9.

\$1,000, 7%, 10-year bond to yield 8%

Value of bond at par	\$1,000.00
Less present value of excess interest,	
\$1,000 × .04 = \$40 Yield rate	
\$1,000 × .035 = 35 Coupon rate	
\$ 5	
Present value of 20 payments of \$5 at 4% = \$5 × 13.5903263 =	\$67.95
Value of bond	\$932.05

TABLE I.—COMPOUND AMOUNT TABLES

AMOUNT OF 1. $a = (1 + i)^n$

n	½ %	1 %	1¼ %	1½ %	1¾ %
1	1.005 0000	1.010 0000	1.012 5000	1.015 0000	1.017 5000
2	1.010 0250	1.020 1000	1.025 1562	1.030 2250	1.035 3062
3	1.015 0751	1.030 3010	1.037 9707	1.045 6784	1.053 4241
4	1.020 1505	1.040 6040	1.050 9453	1.061 3636	1.071 8590
5	1.025 2512	1.051 0100	1.064 0822	1.077 2840	1.090 6166
6	1.030 3775	1.061 5202	1.077 3832	1.093 4433	1.109 7024
7	1.035 5294	1.072 1354	1.090 8505	1.109 8449	1.129 1222
8	1.040 7070	1.082 8567	1.104 4861	1.126 4926	1.148 8818
9	1.045 9106	1.093 6853	1.118 2922	1.143 3900	1.168 9872
10	1.051 1401	1.104 6221	1.132 2708	1.160 5408	1.189 4445
11	1.056 3958	1.115 6684	1.146 4242	1.177 9489	1.210 2598
12	1.061 6778	1.126 8250	1.160 7545	1.195 6182	1.231 4393
13	1.066 9862	1.138 0933	1.175 2640	1.213 5524	1.252 9895
14	1.072 3211	1.149 4742	1.189 9548	1.231 7557	1.274 9168
15	1.077 6827	1.160 9690	1.204 8292	1.250 2321	1.297 2279
16	1.083 0712	1.172 5786	1.219 8896	1.268 9856	1.319 9294
17	1.088 4865	1.184 3044	1.235 1382	1.288 0203	1.343 0281
18	1.093 9289	1.196 1475	1.250 5774	1.307 3406	1.366 5311
19	1.099 3986	1.208 1090	1.266 2096	1.326 9508	1.390 4454
20	1.104 8956	1.220 1900	1.282 0372	1.346 8550	1.414 7782
21	1.110 4201	1.232 3919	1.298 0627	1.367 0578	1.439 5368
22	1.115 9722	1.244 7159	1.314 2885	1.387 5637	1.464 7287
23	1.121 5520	1.257 1630	1.330 7171	1.408 3772	1.490 3615
24	1.127 1598	1.269 7346	1.347 3510	1.429 5028	1.516 4428
25	1.132 7956	1.282 4320	1.364 1929	1.450 9454	1.542 9805
26	1.138 4596	1.295 2563	1.381 2454	1.472 7095	1.569 9827
27	1.144 1518	1.308 2089	1.398 5109	1.494 8002	1.597 4574
28	1.149 8726	1.321 2910	1.415 9923	1.517 2222	1.625 4129
29	1.155 6220	1.334 5039	1.433 6922	1.539 9805	1.653 8576
30	1.161 4001	1.347 8489	1.451 6134	1.563 0802	1.682 8001
31	1.167 2071	1.361 3274	1.469 7585	1.586 5264	1.712 2491
32	1.173 0431	1.374 9407	1.488 1305	1.610 3243	1.742 2135
33	1.178 9083	1.388 6901	1.506 7321	1.634 4792	1.772 7022
34	1.184 8029	1.402 5770	1.525 5663	1.658 9964	1.803 7245
35	1.190 7269	1.416 6028	1.544 6359	1.683 8813	1.835 2897
36	1.196 6805	1.430 7688	1.563 9438	1.709 1395	1.867 4073
37	1.202 6639	1.445 0765	1.583 4931	1.734 7766	1.900 0869
38	1.208 6772	1.459 5272	1.603 2868	1.760 7983	1.933 3384
39	1.214 7206	1.474 1225	1.623 3279	1.787 2102	1.967 1718
40	1.220 7942	1.488 8637	1.643 6195	1.814 0184	2.001 5973
41	1.226 8982	1.503 7524	1.664 1647	1.841 2287	2.036 6253
42	1.233 0327	1.518 7899	1.684 9668	1.868 8471	2.072 2662
43	1.239 1979	1.533 9778	1.706 0288	1.896 8798	2.108 5309
44	1.245 3938	1.549 3176	1.727 3542	1.925 3330	2.145 4302
45	1.251 6208	1.564 8108	1.748 9461	1.954 2130	2.182 9752
46	1.257 8789	1.580 4588	1.770 8080	1.983 5262	2.221 1773
47	1.264 1683	1.596 2634	1.792 9431	2.013 2791	2.260 0479
48	1.270 4892	1.612 2261	1.815 3548	2.043 4783	2.299 5987
49	1.276 8416	1.628 3483	1.838 0468	2.074 1305	2.339 8417
50	1.283 2258	1.644 6318	1.861 0224	2.105 2424	2.380 7889
60	1.348 8502	1.816 6967	2.107 1814	2.443 2198	2.831 8163
70	1.417 8305	2.006 7634	2.385 9000	2.853 4563	3.368 2883
80	1.490 3386	2.216 7152	2.701 4849	3.290 6628	4.006 3919
90	1.566 5547	2.448 6327	3.058 8126	3.818 9485	4.765 3808
100	1.646 6685	2.704 8138	3.463 4043	4.432 0456	5.668 1559

TABLE I.—COMPOUND AMOUNT TABLES.—(*Continued*)

AMOUNT OF 1. $a = (1 + i)^n$

n	2 %	2⅛ %	2¼ %	2⅜ %	2½ %
1	1.020 0000	1.021 2500	1.022 5000	1.023 7500	1.025 0000
2	1.040 4000	1.042 9516	1.045 5062	1.048 0641	1.050 6250
3	1.061 2080	1.065 1143	1.069 0301	1.072 9556	1.076 8906
4	1.082 4322	1.087 7480	1.093 0833	1.098 4383	1.103 8129
5	1.104 0808	1.110 8626	1.117 6777	1.124 5262	1.131 4082
6	1.126 1624	1.134 4684	1.142 8254	1.151 2337	1.159 6934
7	1.148 6857	1.158 5759	1.168 5390	1.178 5755	1.188 6858
8	1.171 6594	1.183 1956	1.194 8311	1.206 5666	1.218 4029
9	1.195 0926	1.208 3385	1.221 7148	1.235 2226	1.248 8630
10	1.218 9944	1.234 0157	1.249 2034	1.264 5592	1.280 0845
11	1.243 3743	1.260 2386	1.277 3105	1.294 5924	1.312 0867
12	1.268 2418	1.287 0186	1.306 0500	1.325 3390	1.344 8888
13	1.293 6066	1.314 3678	1.335 4361	1.356 8158	1.378 5110
14	1.319 4788	1.342 2981	1.365 4834	1.389 0402	1.412 9738
15	1.345 8683	1.370 8219	1.396 2068	1.422 0299	1.448 2982
16	1.372 7857	1.399 9519	1.427 6215	1.445 8031	1.484 5056
17	1.400 2414	1.429 7009	1.459 7429	1.490 3784	1.521 6183
18	1.428 2462	1.460 0820	1.492 5872	1.525 7749	1.559 6587
19	1.456 8112	1.491 1088	1.526 1704	1.562 0120	1.598 6502
20	1.485 9474	1.522 7948	1.560 5092	1.599 1098	1.638 6164
21	1.515 6663	1.555 1542	1.595 6207	1.637 0887	1.679 5818
22	1.545 9797	1.588 2012	1.631 5221	1.675 9696	1.721 5714
23	1.576 8993	1.621 9505	1.668 2314	1.715 7738	1.764 6107
24	1.608 4372	1.656 4170	1.705 7666	1.756 5235	1.808 7260
25	1.640 6060	1.691 6158	1.744 1463	1.798 2409	1.853 9441
26	1.673 4181	1.727 5627	1.783 3896	1.840 9491	1.900 2927
27	1.706 8865	1.764 2734	1.823 5159	1.884 6716	1.947 8000
28	1.741 0242	1.801 7642	1.864 5450	1.929 4326	1.996 4950
29	1.775 8447	1.840 0517	1.906 4972	1.975 2566	2.046 4074
30	1.811 3616	1.879 1528	1.949 3934	2.022 1690	2.097 5676
31	1.847 5888	1.919 0848	1.993 2548	2.070 1955	2.150 0068
32	1.884 5406	1.959 8653	2.038 1030	2.119 3626	2.203 7569
33	1.922 2314	2.001 5124	2.083 9603	2.169 6975	2.258 8509
34	1.960 6760	2.044 0446	2.130 8494	2.221 2278	2.315 3221
35	1.999 8896	2.087 4805	2.178 7936	2.273 9820	2.373 2052
36	2.039 8873	2.131 8395	2.227 8164	2.327 9890	2.432 5353
37	2.080 6851	2.177 1411	2.277 9423	2.383 2788	2.493 3487
38	2.122 2988	2.223 4053	2.329 1960	2.439 8816	2.555 6824
39	2.164 7448	2.270 6527	2.381 6029	2.497 8288	2.619 5745
40	2.208 0397	2.318 9041	2.435 1890	2.557 1523	2.685 0638
41	2.252 2005	2.368 1808	2.489 9807	2.617 8846	2.752 1904
42	2.297 2445	2.418 5046	2.546 0053	2.680 0594	2.820 9952
43	2.343 1894	2.469 8978	2.603 2904	2.743 7108	2.891 5201
44	2.390 0531	2.522 3832	2.661 8644	2.808 8740	2.963 8081
45	2.437 8542	2.575 9838	2.721 7564	2.875 5847	3.037 9033
46	2.486 6113	2.630 7235	2.782 9959	2.943 8798	3.113 8509
47	2.536 3435	2.686 6263	2.845 6133	3.013 7970	3.191 6971
48	2.587 0704	2.743 7172	2.909 6396	3.085 3747	3.271 4896
49	2.638 8118	2.802 0211	2.975 1065	3.158 6523	3.353 2768
50	2.691 5880	2.861 5641	3.042 0464	3.233 6703	3.437 1087
60	3.281 0308	3.531 2151	3.800 1348	4.089 1674	4.399 7898
70	3.999 5582	4.357 5750	4.747 1414	5.170 9940	5.632 1029
80	4.875 4392	5.377 3161	5.930 1453	6.539 0278	7.209 5678
90	5.943 1331	6.635 6926	7.407 9578	8.268 9874	9.228 8563
100	7.244 6461	8.188 5490	9.254 0463	10.456 6236	11.813 7164

TABLE I.—COMPOUND AMOUNT TABLES.—(*Continued*)
AMOUNT OF 1. $a = (1 + i)^n$

n	3%	3½%	4%	4¼%	4½%
1	1.030 0000	1.035 0000	1.040 0000	1.042 5000	1.045 0000
2	1.060 9000	1.071 2250	1.081 6000	1.086 8062	1.092 0250
3	1.092 7270	1.108 7179	1.124 8640	1.132 9955	1.141 1661
4	1.125 5088	1.147 5230	1.169 8586	1.181 1478	1.192 5186
5	1.159 2741	1.187 6863	1.216 6529	1.231 3466	1.246 1819
6	1.194 0523	1.229 2553	1.265 3190	1.283 6788	1.302 2601
7	1.229 8739	1.272 2793	1.315 9318	1.338 2352	1.360 8618
8	1.266 7701	1.316 8090	1.368 5690	1.395 1102	1.422 1006
9	1.304 7732	1.361 8974	1.423 3118	1.454 4024	1.486 0951
10	1.343 9164	1.410 5988	1.480 2443	1.516 2145	1.552 9694
11	1.384 2339	1.459 9697	1.539 4541	1.580 6536	1.622 8530
12	1.425 7609	1.511 0687	1.601 0322	1.647 8314	1.695 8814
13	1.468 5337	1.563 9561	1.665 0735	1.717 8642	1.772 1961
14	1.512 5897	1.618 6945	1.731 6764	1.790 8734	1.851 9449
15	1.557 9674	1.675 3488	1.800 9435	1.866 9855	1.935 2824
16	1.604 7064	1.733 9860	1.872 9812	1.946 3324	2.022 3702
17	1.652 8476	1.794 6756	1.947 9005	2.029 0516	2.113 3768
18	1.702 4331	1.857 4892	2.025 8165	2.115 2862	2.208 4788
19	1.753 5060	1.922 5013	2.106 8492	2.205 1859	2.307 8603
20	1.806 1112	1.989 7889	2.191 1231	2.298 9063	2.411 7140
21	1.860 2946	2.059 4315	2.278 7681	2.396 6098	2.520 2412
22	1.916 1034	2.131 5116	2.369 9188	2.498 4658	2.633 6520
23	1.973 5865	2.206 1145	2.464 7155	2.604 6505	2.752 1664
24	2.032 7941	2.283 3285	2.563 3042	2.715 3482	2.876 0138
25	2.093 7779	2.363 2450	2.665 8363	2.830 7505	3.005 4345
26	2.156 5913	2.445 9586	2.772 4698	2.951 0574	3.140 6790
27	2.221 2890	2.531 5671	2.883 3686	3.076 4773	3.282 0096
28	2.287 9277	2.620 1720	2.998 7033	3.207 2276	3.429 7000
29	2.356 5655	2.711 8780	3.118 6514	3.343 5348	3.584 0365
30	2.427 2625	2.806 7937	3.243 3975	3.485 6350	3.745 3181
31	2.500 0804	2.905 0315	3.373 1334	3.633 7745	3.913 8574
32	2.575 0828	3.006 7076	3.508 0588	3.788 2099	4.089 9810
33	2.652 3352	3.111 9424	3.648 3811	3.949 2088	4.274 0302
34	2.731 9053	3.220 8603	3.794 3163	4.117 0502	4.466 3615
35	2.813 8624	3.333 5904	3.946 0890	4.292 0248	4.667 3478
36	2.898 2783	3.450 2661	4.103 9326	4.474 4359	4.877 3785
37	2.985 2267	3.571 0254	4.268 0899	4.664 5994	5.096 8605
38	3.074 7835	3.696 0113	4.438 8134	4.862 8449	5.326 2192
39	3.167 0270	3.825 3717	4.616 3660	5.069 5158	5.565 8991
40	3.262 0378	3.959 2597	4.801 0206	5.284 9702	5.816 3645
41	3.359 8989	4.097 8338	4.993 0614	5.509 5815	6.078 1009
42	3.460 6959	4.241 2580	5.192 7839	5.743 7387	6.351 6155
43	3.564 5168	4.389 7020	5.400 4953	5.987 8476	6.637 4382
44	3.671 4523	4.543 3416	5.616 5151	6.242 3311	6.936 1229
45	3.781 5958	4.702 3586	5.841 1757	6.507 6302	7.248 2484
46	3.895 0437	4.866 9411	6.074 8227	6.784 2044	7.574 4196
47	4.011 8950	5.037 2840	6.317 8156	7.072 5331	7.915 2685
48	4.132 2519	5.213 5890	6.570 5282	7.373 1158	8.271 4556
49	4.256 2194	5.396 0646	6.833 3494	7.686 4732	8.643 6711
50	4.383 9060	5.584 9269	7.106 6834	8.013 1483	9.032 6363
60	5.891 6031	7.878 0909	10.519 6274	12.149 6514	14.027 4079
70	7.917 8219	11.112 8253	15.571 6184	18.421 4773	21.784 1356
80	10.640 8906	15.675 7375	23.049 7991	27.930 9104	33.830 0964
90	14.300 4671	22.112 1760	34.119 3333	42.349 2505	52.537 1053
100	19.218 6320	31.191 4080	50.504 9482	64.210 5462	81.588 5180

TABLE I.—COMPOUND AMOUNT TABLES.—(*Continued*)

AMOUNT OF 1. $a = (1 + i)^n$

n	4¾ %	5 %	6 %	7 %	8 %
1	1.047 5000	1.050 0000	1.060 0000	1.070 0000	1.080 0000
2	1.097 2562	1.102 5000	1.123 6000	1.144 9000	1.166 4000
3	1.149 3759	1.157 6250	1.191 0160	1.225 0430	1.259 7120
4	1.203 9713	1.215 5062	1.262 4770	1.310 7960	1.360 4890
5	1.261 1599	1.276 2816	1.338 2256	1.402 5517	1.469 3281
6	1.321 0650	1.340 0956	1.418 5191	1.500 7304	1.586 8743
7	1.383 8156	1.407 1004	1.503 6303	1.605 7815	1.713 8243
8	1.449 5468	1.477 4554	1.593 8481	1.718 1862	1.850 9302
9	1.518 4003	1.551 3282	1.689 4790	1.838 4592	1.999 0046
10	1.590 5243	1.628 8946	1.790 8477	1.967 1514	2.158 9250
11	1.666 0742	1.710 3394	1.898 2986	2.104 8520	2.331 6390
12	1.745 2128	1.795 8563	2.012 1965	2.252 1916	2.518 1701
13	1.828 1104	1.885 6491	2.132 9283	2.409 8450	2.719 6237
14	1.914 9456	1.979 9316	2.260 9040	2.578 5342	2.937 1936
15	2.005 9055	2.078 9282	2.396 5582	2.759 0315	3.172 1691
16	2.101 1860	2.182 8746	2.540 3517	2.952 1638	3.425 9426
17	2.200 9924	2.292 0183	2.692 7728	3.158 8152	3.700 0180
18	2.305 5395	2.406 6192	2.854 3392	3.379 9323	3.996 0195
19	2.415 0526	2.526 9502	3.025 5995	3.616 5275	4.315 7011
20	2.529 7676	2.653 2977	3.207 1355	3.869 6845	4.660 9571
21	2.649 9316	2.785 9626	3.399 5636	4.140 5624	5.033 8337
22	2.775 8034	2.925 2607	3.603 5374	4.430 4017	5.436 5404
23	2.907 6540	3.071 5238	3.819 7497	4.740 5299	5.871 4636
24	3.045 7676	3.225 0999	4.048 9346	5.072 3670	6.341 1807
25	3.190 4415	3.386 3549	4.291 8707	5.427 4326	6.848 4752
26	3.341 9875	3.555 6727	4.549 3830	5.807 3529	7.396 3532
27	3.500 7319	3.733 4563	4.822 3459	6.213 8676	7.988 0615
28	3.667 0167	3.920 1291	5.111 6867	6.648 8384	8.627 1064
29	3.841 2000	4.116 1356	5.418 3879	7.114 2570	9.317 2749
30	4.023 6570	4.321 9424	5.743 4912	7.612 2550	10.062 6569
31	4.214 7807	4.538 0395	6.088 1006	8.145 1129	10.867 6694
32	4.414 9828	4.764 9415	6.453 3867	8.715 2708	11.737 0830
33	4.624 6944	5.003 1885	6.840 5899	9.325 3398	12.676 0496
34	4.844 3674	5.253 3480	7.251 0253	9.978 1135	13.690 1336
35	5.074 4749	5.516 0154	7.686 0868	10.676 5815	14.785 3443
36	5.315 5124	5.791 8161	8.147 2520	11.423 9422	15.968 1718
37	5.567 9993	6.081 4069	8.636 0871	12.223 6181	17.245 6256
38	5.832 4792	6.385 4773	9.154 2524	13.079 2714	18.625 2756
39	6.109 5220	6.704 7512	9.703 5075	13.994 8204	20.115 2977
40	6.399 7243	7.039 9887	10.285 7179	14.974 4578	21.724 5215
41	6.703 7112	7.391 9882	10.902 8610	16.022 6699	23.462 4832
42	7.022 1375	7.761 5876	11.557 0327	17.114 2568	25.339 4819
43	7.355 6890	8.149 6669	12.250 4546	18.344 3548	27.366 6404
44	7.705 0843	8.557 1503	12.985 4819	19.628 4596	29.555 9717
45	8.071 0758	8.985 0078	13.764 6108	21.002 4518	31.920 4494
46	8.454 4519	9.434 2582	14.590 4875	22.472 6234	34.474 0853
47	8.856 0383	9.905 9711	15.465 9167	24.045 7070	37.232 0122
48	9.276 7001	10.401 2696	16.393 8717	25.728 9065	40.210 5731
49	9.717 3434	10.921 3331	17.377 5040	27.529 9300	43.427 4190
50	10.178 9172	11.467 3998	18.420 1543	29.457 0251	46.901 6125
60	16.189 8154	18.679 1859	32.987 6908	57.946 4268	101.257 0637
70	25.750 2954	30.426 4255	59.075 9302	113.989 3922	218.606 4059
80	40.956 4712	49.561 4411	105.795 9935	224.234 3876	471.954 8343
90	65.142 2639	80.730 3650	189.464 5112	441.102 9799	1018.915 0893
100	103.610 3555	131.501 2578	339.302 0835	867.716 3256	2199.761 2563

Table II.—Present Value

Present Value of 1. $P.\ V. = \frac{1}{(1+i)^n}$

n	½ %	1 %	1¼ %	1½ %	1¾ %
1	.995 0249	.990 0990	.987 6543	.985 2217	.982 8010
2	.990 0745	.980 2960	.975 4611	.970 6618	.965 8978
3	.985 1488	.970 5902	.963 4183	.956 3170	.949 2853
4	.980 2475	.960 9803	.951 5243	.942 1842	.932 9585
5	.975 3707	.951 4657	.939 7771	.928 2603	.916 9125
6	.970 5181	.942 0452	.928 1749	.914 5422	.901 1425
7	.965 6896	.932 7180	.916 7159	.901 0268	.885 6438
8	.960 8852	.923 4832	.905 3984	.887 7111	.870 4116
9	.956 1047	.914 3398	.894 2207	.874 5922	.855 4414
10	.951 3479	.905 2870	.883 1809	.861 6672	.840 7286
11	.946 6149	.896 3237	.872 2775	.848 9332	.826 2689
12	.941 9053	.887 4492	.861 5086	.836 3874	.812 0579
13	.937 2192	.878 6626	.850 8727	.824 0270	.798 0913
14	.932 5565	.869 9630	.840 3681	.811 8493	.784 3649
15	.927 9169	.861 3495	.829 9932	.799 8515	.770 8746
16	.923 3004	.852 8213	.819 7464	.788 0310	.757 6163
17	.918 7068	.844 3775	.809 6260	.776 3853	.744 5860
18	.914 1362	.836 0173	.799 6306	.764 9116	.731 7799
19	.909 5882	.827 7399	.789 7587	.753 6075	.719 1940
20	.905 0629	.819 5445	.780 0086	.742 4704	.706 8246
21	.900 5601	.811 4302	.770 3788	.731 4980	.694 6679
22	.896 0797	.803 3962	.760 8680	.720 6876	.682 7203
23	.891 6216	.795 4418	.751 4745	.710 0371	.670 9782
24	.887 1857	.787 5661	.742 1971	.699 5439	.659 4380
25	.882 7718	.779 7684	.733 0341	.689 2058	.648 0963
26	.878 3799	.772 0480	.723 9843	.679 0205	.636 9497
27	.874 0099	.764 4039	.715 0463	.668 9857	.625 9948
28	.869 6616	.756 8356	.706 2185	.659 0992	.615 2283
29	.865 3349	.749 3422	.697 4998	.649 3589	.604 6470
30	.861 0297	.741 9229	.688 8887	.639 7624	.594 2476
31	.856 7460	.734 5772	.680 3839	.630 3078	.584 0272
32	.852 4836	.727 3041	.671 9841	.620 9929	.573 9825
33	.848 2424	.720 1031	.663 6880	.611 8157	.564 1105
34	.844 0223	.712 9733	.655 4943	.602 7741	.554 4084
35	.839 8231	.705 9142	.647 4018	.593 8661	.544 8731
36	.835 6449	.698 9250	.639 4092	.585 0897	.535 5018
37	.831 4875	.692 0049	.631 5152	.576 4431	.526 2917
38	.827 3507	.685 1534	.623 7187	.567 9242	.517 2400
39	.823 2346	.678 3697	.616 0185	.559 5313	.508 3440
40	.819 1389	.671 6531	.608 4133	.551 2623	.499 6010
41	.815 0635	.665 0031	.600 9021	.543 1156	.491 0083
42	.811 0085	.658 4189	.593 4835	.535 0892	.482 5635
43	.806 9736	.651 8999	.586 1566	.527 1815	.474 2639
44	.802 9588	.645 4455	.578 9201	.519 3907	.466 1070
45	.798 9640	.639 0549	.571 7729	.511 7149	.458 0904
46	.794 9891	.632 7276	.564 7140	.504 1526	.450 2117
47	.791 0339	.626 4630	.557 7422	.496 7021	.442 4685
48	.787 0984	.620 2604	.550 8565	.489 3617	.434 8585
49	.783 1825	.614 1192	.544 0558	.482 1298	.427 3793
50	.779 2861	.608 0388	.537 3390	.475 0047	.420 0288
60	.741 3722	.550 4496	.474 5676	.409 2960	.353 1302
70	.705 3029	.498 3149	.419 1290	.352 6769	.296 8867
80	.670 9885	.451 1179	.370 1668	.303 8902	.249 6011
90	.638 3435	.408 3912	.326 9242	.261 8522	.209 8468
100	.607 2868	.369 7112	.288 7333	.225 6294	.176 4242

TABLE II.—PRESENT VALUE.—(*Continued*)

PRESENT VALUE OF 1. $P.\ V. = \frac{1}{(1+i)^n}$

n	2 %	2⅛ %	2¼ %	2⅜ %	2½ %
1	.980 3922	.979 1922	.977 9951	.976 8010	.975 6098
2	.961 1688	.958 8173	.956 4744	.954 1402	.951 8144
3	.942 3223	.938 8664	.935 4273	.932 0050	.928 5994
4	.923 8454	.919 3306	.914 8434	.910 3834	.905 9506
5	.905 7308	.900 2013	.894 7123	.889 2634	.883 8543
6	.887 9714	.881 4701	.875 0243	.868 6334	.862 2969
7	.870 5602	.863 1286	.855 7695	.848 4819	.841 2652
8	.853 4904	.845 1688	.836 9384	.828 7980	.820 7466
9	.836 7553	.827 5826	.818 5216	.809 5707	.800 7284
10	.820 3483	.810 3624	.800 5101	.790 7894	.781 1984
11	.804 2630	.793 5006	.782 8950	.772 4439	.762 1448
12	.788 4932	.776 9895	.765 6675	.754 5239	.743 5559
13	.773 0325	.760 8221	.748 8190	.737 0197	.725 4204
14	.757 8750	.744 9910	.732 3414	.719 9216	.707 7272
15	.743 0147	.729 4894	.716 2263	.703 2201	.690 4656
16	.728 4458	.714 3103	.700 4658	.686 9061	.673 6249
17	.714 1626	.699 4470	.685 0521	.670 9705	.657 1951
18	.700 1594	.684 8930	.669 9776	.655 4047	.641 1659
19	.686 4308	.670 6419	.655 2348	.640 1999	.625 5277
20	.672 9713	.656 6873	.640 8165	.625 3479	.610 2709
21	.659 7758	.643 0230	.626 7154	.610 8404	.595 3863
22	.646 8390	.629 6431	.612 9246	.596 6696	.580 8647
23	.634 1559	.616 5416	.599 4372	.582 8274	.566 6972
24	.621 7215	.603 7127	.586 2467	.569 3064	.552 8754
25	.609 5309	.591 1508	.573 3464	.556 0990	.539 3906
26	.597 5793	.578 8502	.560 7300	.543 1981	.526 2347
27	.585 8620	.566 8056	.548 3912	.530 5964	.513 3997
28	.574 3746	.555 0116	.536 3239	.518 2871	.500 8778
29	.563 1123	.543 4630	.524 5221	.506 2633	.488 6612
30	.552 0709	.532 1547	.512 9801	.494 5185	.476 7427
31	.541 2460	.521 0817	.501 6920	.483 0462	.465 1148
32	.530 6333	.510 2392	.490 6523	.471 8400	.453 7706
33	.520 2287	.499 6222	.479 8556	.460 8937	.442 7030
34	.510 0282	.489 2261	.469 2964	.450 2015	.431 9053
35	.500 0276	.479 0464	.458 9696	.439 7572	.421 3711
36	.490 2232	.469 0785	.448 8700	.429 5553	.411 0937
37	.480 6109	.459 3180	.438 9927	.419 5900	.401 0670
38	.471 1872	.449 7606	.429 3327	.409 8559	.391 2849
39	.461 9482	.440 4020	.419 8853	.400 3477	.381 7414
40	.452 8904	.431 2382	.410 6458	.391 0600	.372 4306
41	.444 0102	.422 2651	.401 6095	.381 9878	.363 3470
42	.435 3041	.413 4786	.392 7722	.373 1261	.354 4848
43	.426 7688	.404 8750	.384 1292	.364 4699	.345 8389
44	.418 4007	.396 4505	.375 6765	.356 0146	.337 4038
45	.410 1968	.388 2012	.367 4098	.347 7554	.329 1744
46	.402 1537	.380 1236	.359 3250	.339 6878	.321 1458
47	.394 2684	.372 2140	.351 4181	.331 8074	.313 3129
48	.386 5376	.364 4691	.343 6852	.324 1098	.305 6712
49	.378 9584	.356 8852	.336 1224	.316 5907	.298 2158
50	.371 5279	.349 4592	.328 7261	.309 2461	.290 9422
60	.304 7823	.283 1886	.263 1486	.244 5486	.227 2836
70	.250 0276	.229 4854	.210 6531	.193 3864	.177 5536
80	.205 1097	.185 9664	.168 6299	.152 9279	.138 7046
90	.168 2614	.150 7002	.134 9900	.120 9338	.108 3558
100	.138 0330	.122 1218	.108 0608	.095 6332	.084 6474

TABLE II.—PRESENT VALUE.—(*Continued*)

PRESENT VALUE OF 1. $P.\ V. = \frac{1}{(1+i)^n}$

n	3 %	3½ %	4 %	4¼ %	4½ %
1	.970 8738	.966 1836	.961 5385	.959 2326	.956 9378
2	.942 5959	.933 5107	.924 5562	.920 1272	.915 7300
3	.915 1417	.901 9427	.888 9964	.882 6160	.876 2966
4	.888 4870	.871 4422	.854 8042	.846 6341	.838 5613
5	.862 6088	.841 9732	.821 9271	.812 1190	.802 4510
6	.837 4843	.813 5006	.790 3145	.779 0110	.767 8957
7	.813 0915	.785 9910	.759 9178	.747 2528	.734 8285
8	.789 4092	.759 4116	.730 6902	.716 7893	.703 1851
9	.766 4167	.733 7310	.702 5867	.687 5676	.672 9044
10	.744 0939	.708 9188	.675 5642	.659 5373	.643 9277
11	.722 4213	.684 9457	.649 5809	.632 6497	.616 1987
12	.701 3799	.661 7833	.624 5970	.606 8582	.589 6639
13	.680 9513	.639 4042	.600 5741	.582 1182	.564 2716
14	.661 1178	.617 7818	.577 4751	.558 3868	.539 9729
15	.641 8620	.596 8906	.555 2645	.535 6228	.516 7204
16	.623 1669	.576 7059	.533 9082	.513 7868	.494 4693
17	.605 0164	.557 2038	.513 3732	.492 8411	.473 1764
18	.587 3946	.538 3611	.493 6281	.472 7493	.452 8004
19	.570 2860	.520 1557	.474 6424	.453 4765	.433 3018
20	.553 6758	.502 5659	.456 3870	.434 9894	.414 6429
21	.537 5493	.485 5709	.438 8336	.417 2561	.396 7874
22	.521 8925	.469 1506	.421 9554	.400 2456	.379 7009
23	.506 6918	.453 2856	.405 7263	.383 9287	.363 3501
24	.491 9337	.437 9571	.390 1215	.368 2769	.347 7035
25	.477 6056	.423 1470	.375 1168	.353 2632	.332 7306
26	.463 6947	.408 8377	.360 6892	.338 8616	.318 4025
27	.450 1891	.395 0122	.346 8166	.325 0471	.304 6914
28	.437 0768	.381 6543	.333 4775	.311 7958	.291 5707
29	.424 3464	.368 7482	.320 6514	.299 0847	.279 0150
30	.411 9868	.356 2784	.308 3187	.286 8918	.267 0000
31	.399 9872	.344 2304	.296 4603	.275 1959	.255 5024
32	.388 3370	.332 5897	.285 0579	.263 9769	.244 4999
33	.377 0262	.321 3427	.274 0942	.253 2153	.233 9712
34	.366 0449	.310 4760	.263 5521	.242 8924	.223 8959
35	.355 3834	.299 9769	.253 4155	.232 9903	.214 2544
36	.345 0324	.289 8327	.243 6687	.223 4919	.205 0282
37	.334 9829	.280 0316	.234 2968	.214 3807	.196 1992
38	.325 2262	.270 5619	.225 2854	.205 6409	.187 7504
39	.315 7536	.261 4125	.216 6206	.197 2575	.179 6655
40	.306 5568	.252 5725	.208 2890	.189 2158	.171 9287
41	.297 6280	.244 0314	.200 2779	.181 5020	.164 5251
42	.288 9592	.235 7791	.192 5749	.174 1026	.157 4403
43	.280 5429	.227 8059	.185 1682	.167 0049	.150 6605
44	.272 3718	.220 1023	.178 0464	.160 1966	.144 1728
45	.264 4386	.212 6592	.171 1984	.153 6658	.137 9644
46	.256 7365	.205 4679	.164 6139	.147 4012	.132 0233
47	.249 2588	.198 5197	.158 2826	.141 3921	.126 3381
48	.241 9988	.191 8064	.152 1948	.135 6279	.120 8977
49	.234 9503	.185 3202	.146 3411	.130 0987	.115 6916
50	.228 1071	.179 0534	.140 7126	124 7949	.110 7096
60	.169 7331	.126 9343	.095 0604	.082 3069	.071 2890
70	.126 2974	.089 9861	.064 2194	.054 2845	.045 9050
80	.093 9771	.063 7928	.043 3843	.035 8026	.029 5595
90	.069 9278	.045 2240	.029 3089	.023 6132	.019 0342
100	.052 0328	.032 0601	.019 8000	.015 5738	.012 2566

TABLE II.—PRESENT VALUE.—(*Continued*)

PRESENT VALUE OF 1. $P.\ V. = \frac{1}{(1+i)^n}$

n	4¾ %	5 %	6 %	7 %	8 %
1	.954 6539	.952 3810	.943 3962	.934 5794	.925 9259
2	.911 3641	.907 0295	.889 9964	.873 4387	.857 3388
3	.870 0374	.863 8376	.839 6193	.816 2979	.793 8322
4	.830 5846	.822 7025	.792 0937	.762 8952	.735 0298
5	.792 9209	.783 5262	.747 2582	.712 9862	.680 5832
6	.756 9650	.746 2154	.704 9605	.666 3422	.630 1696
7	.722 6396	.710 6813	.665 0571	.622 7497	.583 4904
8	.689 8708	.676 8394	.627 4124	.582 0091	.540 2689
9	.658 5878	.644 6089	.591 8985	.543 9337	.500 2490
10	.628 7235	.613 9132	.558 3948	.508 3493	.463 1935
11	.600 2134	.584 6793	.526 7875	.475 0928	.428 8829
12	.572 9960	.556 8374	.496 9694	.444 0120	.397 1138
13	.547 0129	.530 3214	.468 8390	.414 9644	.367 6979
14	.522 2080	.505 0680	.442 3010	.387 8172	.340 4610
15	.498 5280	.481 0171	.417 2651	.362 4460	.315 2417
16	.475 9217	.458 1115	.393 6463	.338 7346	.291 8905
17	.454 3405	.436 2967	.371 3644	.316 5744	.270 2690
18	.433 7380	.415 5206	.350 3438	.295 8639	.250 2490
19	.414 0696	.395 7340	.330 5130	.276 5083	.231 7121
20	.395 2932	.376 8895	.311 8047	.258 4190	.214 5482
21	.377 3682	.358 9424	.294 1554	.241 5131	.198 6558
22	.360 2561	.341 8499	.277 5051	.225 7132	.183 9405
23	.343 9199	.325 5713	.261 7973	.210 9469	.170 3153
24	.328 3245	.310 0679	.246 9786	.197 1466	.157 6993
25	.313 4362	.295 3028	.232 9986	.184 2492	.146 0179
26	.299 2231	.281 2407	.219 8100	.172 1955	.135 2018
27	.285 6546	.267 8483	.207 3680	.160 9304	.125 1868
28	.272 7012	.255 0936	.195 6301	.150 4022	.115 9137
29	.260 3353	.242 9463	.184 5567	.140 5628	.107 3275
30	.248 5301	.231 3774	.174 1101	.131 3671	.099 3773
31	.237 2603	.220 3595	.164 2548	.122 7730	.092 0160
32	.226 5014	.209 8662	.154 9574	.114 7411	.085 2000
33	.216 2305	.199 8725	.146 1862	.107 2347	.078 8889
34	.206 4253	.190 3548	.137 9115	.100 2193	.073 0453
35	.197 0647	.181 2903	.130 1052	.093 6629	.067 6345
36	.188 1286	.172 6574	.122 7408	.087 5355	.062 6246
37	.179 5977	.164 4356	.115 7932	.081 8088	.057 9857
38	.171 4537	.156 6054	.109 2388	.076 4569	.053 6905
39	.163 6789	.149 1480	.103 0555	.071 4550	.049 7134
40	.156 2567	.142 0457	.097 2222	.066 7804	.046 0309
41	.149 1711	.135 2816	.091 7190	.062 4116	.042 6212
42	.142 4068	.128 8396	.086 5274	.058 3286	.039 4641
43	.135 9492	.122 7044	.081 6296	.054 5127	.036 5408
44	.129 7844	.116 8613	.077 0091	.050 9464	.033 8341
45	.123 8992	.111 2965	.072 6501	.047 6135	.031 3279
46	.118 2809	.105 9967	.068 5378	.044 4986	.029 0073
47	.112 9173	.100 9492	.064 6583	.041 5875	.026 8586
48	.107 7970	.096 1421	.060 9984	.038 8668	.024 8691
49	.102 9088	.091 5639	.057 5457	.036 3241	.023 0269
50	.098 2423	.087 2037	.054 2884	.033 9478	.021 3212
60	.061 7672	.053 5355	.030 3143	.017 2573	.009 8758
70	.038 8345	.032 8662	.016 9274	.008 7728	.004 5744
80	.024 4162	.020 1770	.009 4522	.004 4596	.002 1188
90	.015 3510	.012 3869	.005 2780	.002 2670	.000 9814
100	.009 6515	.007 6045	.002 9472	.001 1524	.000 4546

Table III.—Amount of Annuity

Amount of 1 per Annum. $A = \frac{(1+i)^n - 1}{i} = \frac{a-1}{i}$

n	½ %	1 %	1¼ %	1½ %	1¾ %
1	1.000 0000	1.000 0000	1.000 0000	1.000 0000	1.000 0000
2	2.005 0000	2.010 0000	2.012 5000	2.015 0000	2.017 5000
3	3.015 0250	3.030 1000	3.037 6562	3.045 2250	3.052 8062
4	4.030 1001	4.060 4010	4.075 6270	4.090 9034	4.106 2304
5	5.050 2506	5.101 0050	5.126 5723	5.152 2669	5.178 0894
6	6.075 5019	6.152 0151	6.190 6544	6.229 5509	6.268 7060
7	7.105 8794	7.213 5352	7.268 0376	7.322 9942	7.378 4083
8	8.141 4088	8.285 6706	8.358 8881	8.432 8391	8.507 5304
9	9.182 1158	9.368 5273	9.463 3742	9.559 3317	9.656 4122
10	10.228 0264	10.462 2125	10.581 6664	10.702 7217	10.825 3994
11	11.279 1665	11.566 8347	11.713 9372	11.863 2625	12.014 8439
12	12.335 5624	12.682 5030	12.860 3614	13.041 2114	13.225 1037
13	13.397 2402	13.809 3280	14.021 1159	14.236 8296	14.456 5430
14	14.464 2264	14.947 4213	15.196 3799	15.450 3820	15.709 5325
15	15.536 5475	16.096 8955	16.386 3346	16.682 1378	16.984 4494
16	16.614 2303	17.257 8645	17.591 1638	17.932 3698	18.281 6772
17	17.697 3014	18.430 4431	18.811 0534	19.201 3554	19.601 6066
18	18.785 7879	19.614 7476	20.046 1915	20.489 3757	20.944 6347
19	19.879 7168	20.810 8950	21.296 7689	21.796 7164	22.311 1658
20	20.979 1154	22.019 0040	22.562 9785	23.123 6671	23.701 6112
21	22.084 0110	23.239 1940	23.845 0158	24.470 5221	25.116 3894
22	23.194 4311	24.471 5860	25.143 0785	25.837 5799	26.555 9262
23	24.310 4032	25.716 3018	26.457 3670	27.225 1436	28.020 6549
24	25.431 9552	26.973 4648	27.788 0840	28.633 5208	29.511 0164
25	26.559 1150	28.243 1995	29.135 4351	30.063 0236	31.027 4592
26	27.691 9106	29.525 6315	30.499 6280	31.513 9690	32.570 4397
27	28.830 3702	30.820 8878	31.880 8734	32.986 6785	34.140 4224
28	29.974 5220	32.129 0967	33.279 3843	34.481 4787	35.737 8798
29	31.124 3946	33.450 3877	34.695 3766	35.998 7008	37.363 2927
30	32.280 0166	34.784 8915	36.129 0688	37.538 6814	39.017 1503
31	33.441 4167	36.132 7404	37.580 6822	39.101 7616	40.699 9504
32	34.608 6238	37.494 0678	39.050 4407	40.688 2880	42.412 1996
33	35.781 6669	38.869 0085	40.538 5712	42.298 6123	44.154 4130
34	36.960 5752	40.257 6986	42.045 3033	43.933 0915	45.927 1153
35	38.145 3781	41.660 2756	43.570 8696	45.592 0879	47.730 8398
36	39.336 1050	43.076 8784	45.115 5055	47.275 9692	49.566 1295
37	40.532 7855	44.507 6471	46.679 4493	48.985 1087	51.433 5368
38	41.735 4494	45.952 7236	48.262 9424	50.719 8854	53.333 6236
39	42.944 1267	47.412 2508	49.866 2292	52.480 6837	55.266 9621
40	44.158 8473	48.886 3734	51.489 5571	54.267 8939	57.234 1339
41	45.379 6415	50.375 2371	53.133 1765	56.081 9123	59.235 7312
42	46.606 5397	51.878 9895	54.797 3412	57.923 1410	61.272 3565
43	47.839 5724	53.397 7794	56.482 3080	59.791 9881	63.344 6228
44	49.078 7703	54.931 7572	58.188 3369	61.688 8679	65.453 1537
45	50.324 1642	56.481 0747	59.915 6911	63.614 2010	67.598 5839
46	51.575 7850	58.045 8855	61.664 6372	65.568 4140	69.781 5591
47	52.833 6639	59.626 3443	63.435 4452	67.551 9402	72.002 7364
48	54.097 8322	61.222 6078	65.228 3882	69.565 2193	74.262 7842
49	55.368 3214	62.834 8338	67.043 7431	71.608 6976	76.562 3830
50	56.645 1630	64.463 1822	68.881 7899	73.682 8280	78.902 2247
60	69.770 0305	81.669 6699	88.574 5078	96.214 6517	104.675 2159
70	83.566 1055	100.676 3368	110.871 9978	122.363 7530	135.330 7583
80	98.067 7136	121.671 5217	136.118 7953	152.710 8525	171.793 8242
90	113.310 9358	144.863 2675	164.705 0076	187.929 9004	215.164 6172
100	129.333 6984	170.481 3829	197.072 3420	228.803 0433	266.751 7679

TABLE III.—AMOUNT OF ANNUITY.—(*Continued*)

AMOUNT OF 1 PER ANNUM. $A = \frac{(1+i)^n - 1}{i} = \frac{a-1}{i}$

n	2 %	2⅛ %	2¼ %	2⅜ %	2½ %
1	1.000 0000	1.000 0000	1.000 0000	1.000 0000	1.000 0000
2	2.020 0000	2.021 2500	2.022 5000	2.023 7500	2.025 0000
3	3.060 4000	3.064 2016	3.068 0062	3.071 8141	3.075 6250
4	4.121 6080	4.129 3158	4.137 0364	4.144 7696	4.152 5156
5	5.204 0402	5.217 0638	5.230 1197	5.243 2079	5.256 3285
6	6.308 1210	6.327 9264	6.347 7974	6.367 7341	6.387 7367
7	7.434 2834	7.462 3948	7.490 6228	7.518 9678	7.547 4302
8	8.582 9690	8.620 9707	8.659 1619	8.697 5433	8.736 1159
9	9.754 6284	9.804 1664	9.853 9930	9.904 1099	9.954 5188
10	10.949 7210	11.012 5049	11.075 7078	11.139 3326	11.203 3818
11	12.168 7154	12.246 5206	12.324 9113	12.403 8917	12.483 4663
12	13.412 0897	13.506 7592	13.602 2218	13.698 4841	13.795 5530
13	14.680 3315	14.793 7778	14.908 2718	15.023 8231	15.140 4418
14	15.973 9382	16.108 1456	16.243 7079	16.380 6389	16.518 9528
15	17.293 4169	17.450 4437	17.609 1913	17.769 6791	17.931 9267
16	18.639 2852	18.821 2656	19.005 3981	19.191 7090	19.380 2248
17	20.012 0710	20.221 2175	20.433 0196	20.647 5121	20.864 7304
18	21.412 3124	21.650 9184	21.892 7625	22.137 8905	22.386 3487
19	22.840 5586	23.111 0004	23.385 3497	23.663 6654	23.946 0074
20	24.297 3698	24.602 1092	24.911 5200	25.225 6774	25.544 6576
21	25.783 3172	26.124 9040	26.472 0292	26.824 7873	27.183 2740
22	27.298 9835	27.680 0582	28.067 6499	28.461 8760	28.862 8559
23	28.844 9632	29.268 2594	29.699 1720	30.137 8455	30.584 4273
24	30.421 8625	30.890 2100	31.367 4034	31.853 6194	32.349 0380
25	32.030 2997	32.546 6269	33.073 1700	33.610 1428	34.157 7639
26	33.670 9057	34.238 2427	34.817 3163	35.408 3837	36.011 7080
27	35.344 3238	35.965 8054	36.600 7059	37.249 3328	37.912 0007
28	37.051 2103	37.730 0788	38.424 2218	39.134 0045	39.859 8008
29	38.792 2345	39.531 8429	40.288 7668	41.063 4371	41.856 2958
30	40.568 0792	41.371 8946	42.195 2640	43.038 6937	43.902 7032
31	42.379 4408	43.251 0474	44.144 6575	45.060 8627	46.000 2707
32	44.227 0296	45.170 1321	46.137 9123	47.131 0582	48.150 2775
33	46.111 5702	47.129 9974	48.176 0153	49.250 4208	50.354 0344
34	48.033 8016	49.131 5099	50.259 9756	51.420 1183	52.612 8853
35	49.994 4776	51.175 5544	52.390 8251	53.641 3461	54.928 2074
36	51.994 3672	53.263 0350	54.569 6186	55.915 3281	57.301 4126
37	54.034 2545	55.394 8745	56.797 4351	58.243 3171	59.733 9479
38	56.114 9396	57.572 0156	59.075 3774	60.626 5959	62.227 2966
39	58.237 2384	59.795 4209	61.404 5733	63.066 4776	64.782 9791
40	60.401 9832	62.066 0736	63.786 1762	65.564 3064	67.402 5535
41	62.610 0228	64.384 9776	66.221 3652	68.121 4587	70.087 6174
42	64.862 2233	66.753 1584	68.711 3459	70.739 3433	72.839 8078
43	67.159 4678	69.171 6630	71.257 3512	73.419 4027	75.660 8030
44	69.502 6571	71.641 5609	73.860 6416	76.163 1135	78.552 3231
45	71.892 7103	74.163 9440	76.522 5060	78.971 9875	81.516 1312
46	74.330 5645	76.739 9278	79.244 2624	81.847 5722	84.554 0344
47	76.817 1758	79.370 6513	82.027 2583	84.791 4520	87.667 8853
48	79.353 5193	82.057 2777	84.872 8716	87.805 2490	90.859 5824
49	81.940 5897	84.800 9948	87.782 5113	90.890 6237	94.131 0720
50	84.579 4014	87.603 0160	90.757 6178	94.049 2760	97.484 3488
60	114.051 5394	119.116 0045	124.450 4349	130.070 2048	135.991 5900
70	149.977 9111	158.003 5281	166.539 6176	175.620 8000	185.284 1142
80	193.771 9578	205.991 3438	219.117 5688	233.222 2217	248.382 7126
90	247.156 6563	265.209 0632	284.798 1256	306.062 6266	329.154 2533
100	312.232 3059	338.284 6605	366.846 5021	398.173 6268	432.548 6540

TABLE III.—AMOUNT OF ANNUITY.—(*Continued*)

AMOUNT OF 1 PER ANNUM. $A = \frac{(1+i)^n - 1}{i} = \frac{a-1}{i}$

n	3 %	3½ %	4 %	4¼ %	4½ %
1	1.000 0000	1.000 0000	1.000 0000	1.000 0000	1.000 0000
2	2.030 0000	2.035 0000	2.040 0000	2.042 5000	2.045 0000
3	3.090 9000	3.106 2250	3.121 6000	3.129 3062	3.137 0250
4	4.183 6270	4.214 9429	4.246 4640	4.262 3018	4.278 1911
5	5.309 1358	5.362 4659	5.416 3226	5.443 4496	5.470 7097
6	6.468 4099	6.550 1522	6.632 9755	6.674 7962	6.716 8917
7	7.662 4622	7.779 4075	7.898 2945	7.958 4750	8.019 1518
8	8.892 3360	9.051 6868	9.214 2263	9.296 7102	9.380 0136
9	10.159 1061	10.368 4958	10.582 7953	10.691 8204	10.802 1142
10	11.463 8793	11.731 3932	12.006 1071	12.146 2228	12.288 2094
11	12.807 7957	13.141 9919	13.486 3514	13.662 4372	13.841 1788
12	14.192 0296	14.601 9616	15.025 8055	15.243 0908	15.464 0318
13	15.617 7904	16.113 0303	16.626 8377	16.890 9222	17.159 9133
14	17.086 3242	17.676 9864	18.291 9112	18.608 7864	18.932 1094
15	18.598 9139	19.295 6809	20.023 5876	20.399 6598	20.784 0543
16	20.156 8813	20.971 0297	21.824 5311	22.266 6453	22.719 3367
17	21.761 5877	22.705 0158	23.697 5124	24.212 9778	24.741 7069
18	23.414 4354	24.499 6913	25.645 4129	26.242 0293	26.855 0837
19	25.116 8684	26.357 1805	27.671 2294	28.357 3156	29.063 5625
20	26.870 3745	28.279 6818	29.778 0786	30.562 5015	31.371 4228
21	28.676 4857	30.269 4707	31.969 2017	32.861 4078	33.783 1368
22	30.536 7803	32.328 9022	34.247 9698	35.258 0176	36.303 3780
23	32.452 8837	34.460 4137	36.617 8886	37.756 4834	38.937 0300
24	34.426 4702	36.666 5282	39.082 6041	40.361 1339	41.689 1963
25	36.459 2643	38.949 8567	41.645 9083	43.076 4821	44.565 2102
26	38.553 0422	41.313 1017	44.311 7446	45.907 2326	47.570 6446
27	40.709 6335	43.759 0602	47.084 2144	48.858 2900	50.711 3236
28	42.930 9225	46.290 6273	49.967 5830	51.934 7673	53.993 3332
29	45.218 8502	48.910 7993	52.966 2863	55.141 9949	57.423 0332
30	47.575 4157	51.622 6773	56.084 9378	58.485 5297	61.007 0697
31	50.002 6782	54.429 4710	59.328 3353	61.971 1647	64.752 3878
32	52.502 7585	57.334 5025	62.701 4687	65.604 9392	68.666 2452
33	55.077 8413	60.341 2100	66.209 5274	69.393 1491	72.756 2263
34	57.730 1765	63.453 1524	69.857 9085	73.342 3580	77.030 2565
35	60.462 0818	66.674 0127	73.652 2249	77.459 4082	81.496 6180
36	63.275 9443	70.007 6032	77.598 3138	81.751 4330	86.163 9658
37	66.174 2226	73.457 8693	81.702 2464	86.225 8690	91.041 3443
38	69.159 4493	77.028 8947	85.970 3363	90.890 4684	96.138 2048
39	72.234 2328	80.724 9060	90.409 1497	95.753 3133	101.464 4240
40	75.401 2597	84.550 2778	95.025 5157	100.822 8291	107.030 3231
41	78.663 2975	88.509 5375	99.826 5363	106.107 7993	112.846 6876
42	82.023 1964	92.607 3713	104.819 5978	111.617 3808	118.924 7885
43	85.483 8923	96.848 6293	110.012 3817	117.361 1195	125.276 4040
44	89.048 4091	101.238 3313	115.412 8770	123.348 9671	131.913 8422
45	92.719 8614	105.781 6729	121.029 3920	129.591 2982	138.849 9651
46	96.501 4572	110.484 0314	126.870 5677	136.098 9283	146 098 2135
47	100.396 5010	115.350 9726	132.945 3904	142.883 1328	153.672 6331
48	104.408 3960	120.388 2566	139.263 2060	149.955 6659	161.587 9016
49	108.540 6478	125.601 8456	145.833 7343	157.328 7817	169.859 3572
50	112.796 8673	130.997 9102	152.667 0837	165.015 2550	178.503 0283
60	163.053 4368	196.516 8829	237.990 6852	262.344 7398	289 497 9540
70	230.594 0637	288.937 8646	364.290 4588	409.917 1129	461.869 6796
80	321.363 0186	419.306 7868	551.244 9768	633.668 4800	729.557 6985
90	443.348 9036	603.205 0270	827.983 3335	972.923 5402	1145.269 0066
100	607.287 7327	862.611 6567	1237.623 7046	1487.306 9707	1790.855 9563

TABLE III.—AMOUNT OF ANNUITY.—(*Continued*)

AMOUNT OF 1 PER ANNUM. $A = \frac{(1+i)^n - 1}{i} = \frac{a-1}{i}$

n	4¾ %	5 %	6 %	7 %	8 %
1	1.000 0000	1.000 0000	1.000 0000	1.000 0000	1.000 0000
2	2.047 5000	2.050 0000	2.060 0000	2.070 0000	2.080 0000
3	3.144 7562	3.152 5000	3.183 6000	3.214 9000	3.246 4000
4	4.294 1322	4.310 1250	4.374 6160	4.439 9430	4.506 1120
5	5.498 1034	5.525 6312	5.637 0930	5.750 7390	5.866 6010
6	6.759 2634	6.801 9128	6.975 3185	7.153 2907	7.335 9290
7	8.080 3284	8.142 0084	8.393 8376	8.654 0211	8.922 8034
8	9.464 1440	9.549 1089	9.897 4679	10.259 8026	10.636 6276
9	10.913 6908	11.026 5643	11.491 3160	11.977 9888	12.487 5578
10	12.432 0911	12.577 8925	13.180 7949	13.816 4480	14.486 5625
11	14.022 6154	14.206 7872	14.971 6426	15.783 5993	16.645 4875
12	15.688 6897	15.917 1265	16.869 9412	17.888 4513	18.977 1265
13	17.433 9024	17.712 9828	18.882 1377	20.140 6429	21.495 2966
14	19.262 0128	19.598 6320	21.015 0659	22.550 4879	24.214 9203
15	21.176 9584	21.578 5636	23.275 9699	25.129 0220	27.152 1139
16	23.182 8640	23.657 4918	25.672 5281	27.888 0536	30.324 2830
17	25.284 0500	25.840 3664	28.212 8798	30.840 2173	33.750 2257
18	27.485 0424	28.132 3847	30.905 6526	33.999 0325	37.450 2437
19	29.790 5819	30.539 0039	33.759 9917	37.378 9648	41.446 2632
20	32.205 6345	33.065 9541	36.785 5912	40.995 4923	45.761 9643
21	34.735 4022	35.719 2518	39.992 7267	44.865 1768	50.422 9214
22	37.385 3338	38.505 2144	43.392 2903	49.005 7392	55.456 7552
23	40.161 1371	41.430 4751	46.995 8277	53.436 1409	60.893 2956
24	43.068 7911	44.501 9989	50.815 5774	58.176 6708	66.764 7592
25	46.114 5587	47.727 0988	54.864 5120	63.249 0377	73.105 9400
26	49.305 0002	51.113 4538	59.156 3827	68.676 4704	79.954 4152
27	52.646 9877	54.669 1264	63.705 7657	74.483 8233	87.350 7684
28	56.147 7197	58.402 5828	68.528 1116	80.697 6909	95.338 8298
29	59.814 7363	62.322 7119	73.639 7983	87.346 5293	103.965 9362
30	63.655 9363	66.438 8475	79.058 1862	94.460 7863	113.283 2111
31	67.679 5933	70.760 7899	84.801 6774	102.073 0414	123.345 8680
32	71.894 3740	75.298 8294	90.889 7780	110.218 1543	134.213 5374
33	76.309 3567	80.063 7708	97.343 1647	118.933 4251	145.950 6204
34	80.934 0512	85.066 9594	104.183 7546	128.258 7648	158.626 6701
35	85.778 4186	90.320 3074	111.434 7799	138.236 8784	172.316 8037
36	90.852 8935	95.836 3227	119.120 8667	148.913 4598	187.102 1480
37	96.168 4059	101.628 1389	127.268 1187	160.337 4020	203.070 3198
38	101.736 4052	107.709 5458	135.904 2058	172.561 0202	220.315 9454
39	107.568 8845	114.095 0231	145.058 4581	185.640 2916	238.941 2210
40	113.678 4065	120.799 7742	154.761 9656	199.635 1120	259.056 5187
41	120.078 1308	127.839 7630	165.047 6836	214 609 5698	280.781 0402
42	126.781 8420	135.231 7511	175.950 5446	230.632 2397	304.243 5234
43	133.803 9795	142.993 3387	187.507 5772	247.776 4965	329.583 0053
44	141.159 6685	151.143 0056	199.758 0319	266.120 8512	356.949 6457
45	148.864 7528	159.700 1559	212.743 5138	285.749 3108	386.505 6174
46	156.935 8285	168.685 1637	226.508 1246	306.751 7626	418 426 0668
47	165.390 2804	178.119 4218	241.098 6121	329.224 3860	452.900 1521
48	174 246 3187	188.025 3929	256.564 5288	353.270 0930	490.132 1643
49	183.523 0188	198.426 6626	272.958 4006	378.998 9995	530.342 7374
50	193.240 3622	209.347 9957	290.335 9046	406.528 9295	573.770 1564
60	319.785 5885	353.583 7179	533.128 1809	813.520 3834	1253.213 2958
70	521.058 8495	588.528 5107	967.932 1696	1614.134 1742	2720.080 0738
80	841.188 8678	971.228 8213	1746.599 8914	3189.062 6797	5886.935 4283
90	1350.363 4500	1594.607 3010	3141.075 1872	6287.185 4268	12723.938 6160
100	2160.218 0106	2610.025 1569	5638.368 0586	12381.661 7938	27484.515 7043

Table IV.—Present Value of Annuity

Present Value of 1 per Annum. $P.\ V.\ A. = \dfrac{1 - \dfrac{1}{(1+i)^n}}{i} = \dfrac{D}{i}$

n	½ %	1 %	1¼ %	1½ %	1¾ %
1	.995 0249	.990 0990	.987 6543	.985 2217	.982 8010
2	1.985 0994	1.970 3951	1.963 1154	1.955 8834	1.948 6988
3	2.970 2481	2.940 9852	2.926 5337	2.912 2004	2.897 9840
4	3.950 4957	3.901 9656	3.878 0580	3.854 3846	3.830 9425
5	4.925 8663	4.853 4312	4.817 8350	4.782 6450	4.747 8551
6	5.896 3844	5.795 4765	5.746 0099	5.697 1872	4.648 9976
7	6.862 0740	6.728 1945	6.662 7258	6.598 2140	6.534 6414
8	7.822 9592	7.651 6778	7.568 1243	7.485 9251	7.405 0530
9	8.779 0639	8.566 0176	8.462 3450	8.360 5173	8.260 4943
10	9.730 4119	9.471 3045	9.345 5259	9.222 1846	9.101 2229
11	10.677 0267	10.367 6282	10.217 8034	10.071 1178	9.927 4918
12	11.618 9321	11.255 0775	11.079 3120	10.907 5052	10.739 5497
13	12.556 1513	12.133 7401	11.930 1847	11.731 5322	11.537 6410
14	13.488 7078	13.003 7030	12.770 5528	12.543 3815	12.322 0059
15	14.416 6246	13.865 0525	13.600 5459	13.343 2330	13.092 8805
16	15.339 9250	14.717 8738	14.420 2923	14.131 2640	13.850 4968
17	16.258 6319	15.562 2513	15.229 9183	14.907 6493	14.595 0828
18	17.172 7680	16.398 2686	16.029 5489	15.672 5609	15.326 8627
19	18.082 3562	17.226 0085	16.819 3076	16.426 1684	16.046 0567
20	18.987 4192	18.045 5530	17.599 3161	17.168 6388	16.752 8813
21	19.887 9792	18.856 9831	18.369 6950	17.900 1367	17.447 5492
22	20.784 0590	19.660 3793	19.130 5629	18.620 8244	18.130 2695
23	21.675 6806	20.455 8211	19.882 0374	19.330 8614	18.801 2476
24	22.562 8662	21.243 3873	20.624 2345	20.030 4054	19.460 6856
25	23.445 6380	22.023 1557	21.357 2686	20.719 6112	20.108 7820
26	24.324 0179	22.795 2037	22.081 2530	21.398 6317	20.745 7317
27	25.198 0278	23.559 6076	22.796 2992	22.067 6175	21.371 7264
28	26.067 6894	24.316 4432	23.502 5178	22.726 7167	21.986 9547
29	26.933 0242	25.065 7853	24.200 0176	23.376 0756	22.591 6017
30	27.794 0540	25.807 7082	24.888 9062	24.015 8380	23.185 8493
31	28.650 8000	26.542 2854	25.569 2901	24.646 1458	23.769 8765
32	29.503 2836	27.269 5895	26.241 2742	25.267 1387	24.343 8590
33	30.351 5259	27.989 6926	26.904 9622	25.878 9544	24.907 9695
34	31.195 5482	28.702 6659	27.560 4564	26.481 7285	25.462 3779
35	32.035 3713	29.408 5801	28.207 8582	27.075 5946	26.007 2510
36	32.871 0162	30.107 5050	28.847 2674	27.660 6843	26.542 7528
37	33.702 5037	30.799 5099	29.478 7826	28.237 1274	27.069 0446
38	34.529 8544	31.484 6633	30.102 5013	28.805 0516	27.586 2846
39	35.353 0890	32.163 0330	30.718 5198	29.364 5829	28.094 6286
40	36.172 2279	32.834 6861	31.326 9332	29.915 8452	28.594 2296
41	36.987 2914	33.499 6892	31.927 8352	30.458 9608	29.085 2379
42	37.798 2999	34.158 1081	32.521 3187	30.994 0500	29.567 8014
43	38.605 2735	34.810 0081	33.107 4753	31.521 2316	30.042 0652
44	39.408 2324	35.455 4535	33.686 3954	32.040 6222	30.508 1722
45	40.207 1964	36.094 5084	34.258 1682	32.552 3372	30.966 2626
46	41.002 1855	36.727 2361	34.822 8822	33.056 4898	31.416 4743
47	41.793 2194	37.353 6991	35.380 6244	33.553 1920	31.858 9428
48	42.580 3178	37.973 9595	35.931 4809	34.042 5536	32.293 8013
49	43.363 5003	38.588 0787	36.475 5367	34.524 6834	32.721 1806
50	44.142 7864	39.196 1175	37.012 8757	34.999 6881	33.141 2095
60	51.725 5608	44.955 0384	42.034 5918	39.380 2689	36.963 9855
70	58.939 4176	50.168 5144	46.469 6756	43.154 8718	40.177 9027
80	65.802 3054	54.888 2061	50.386 6571	46.407 3235	42.879 9347
90	72.331 2996	59.160 8815	53.846 0604	49.209 8545	45.151 6104
100	78.542 6448	63.028 8788	56.901 3394	51.624 7037	47.061 4730

TABLE IV.—PRESENT VALUE OF ANNUITY.—(*Continued*)

PRESENT VALUE OF 1 PER ANNUM. $P.\ V.\ A. = \dfrac{1 - \dfrac{1}{(1+i)^n}}{i} = \dfrac{D}{i}$

n	2 %	2⅛ %	2¼ %	2⅜ %	2½ %
1	.980 3922	.979 1922	.977 9951	.976 8010	.975 6098
2	1.941 5609	1.938 0095	1.934 4696	1.930 9411	1.927 4242
3	2.883 8833	2.876 8758	2.869 8969	2.862 9462	2.856 0236
4	3.807 7287	3.796 2065	3.784 7402	3.773 3296	3.761 9742
5	4.713 4595	4.696 4078	4.679 4525	4.662 5930	4.645 8285
6	5.601 4309	5.577 8779	5.554 4768	5.531 2264	5.508 1254
7	6.471 9911	6.441 0065	6.410 2463	6.379 7083	6.349 3906
8	7.325 4814	7.286 1753	7.247 1846	7.208 5063	7.170 1372
9	8.162 2367	8.113 7579	8.065 7062	8.018 0769	7.970 8655
10	8.982 5850	8.924 1204	8.866 2164	8.808 8664	8.752 0639
11	9.786 8480	9.717 6209	9.649 1113	9.581 3102	9.514 2087
12	10.575 3412	10.494 6104	10.414 7788	10.335 8342	10.257 7646
13	11.348 3738	11.255 4325	11.163 5979	11.072 8539	10.983 1850
14	12.106 2488	12.000 4235	11.895 9392	11.792 7755	11.690 9122
15	12.849 2635	12.729 9129	12.612 1655	12.495 9956	12.381 3777
16	13.577 7093	13.444 2231	13.312 6313	13.182 9017	13.055 0027
17	14.291 8719	14.143 6701	13.997 6834	13.853 8722	13.712 1977
18	14.992 0312	14.828 5632	14.667 6611	14.509 2769	14.353 3636
19	15.678 4620	15.499 2051	15.322 8959	15.149 4768	14.978 8913
20	16.351 4333	16.155 8923	15.963 7124	15.774 8247	15.589 1623
21	17.011 2092	16.798 9154	16.590 4278	16.385 6652	16.184 5486
22	17.658 0482	17.428 5585	17.203 3523	16.982 3347	16.765 4132
23	18.292 2041	18.045 1002	17.802 7896	17.565 1621	17.332 1105
24	18.913 9256	18.648 8129	18.389 0362	18.134 4685	17.884 9858
25	19.523 4565	19.239 9636	18.962 3826	18.690 5675	18.424 3764
26	20.121 0358	19.818 8138	19.523 1126	19.233 7656	18.950 6111
27	20.706 8978	20.385 6194	20.071 5038	19.764 3620	19.464 0109
28	21.281 2724	20.940 6310	20.607 8276	20.282 6491	19.964 8887
29	21.844 3847	21.484 0940	21.132 3498	20.788 9124	20.453 5499
30	22.396 4556	22.016 2487	21.645 3298	21.283 4309	20.930 2926
31	22.937 7015	22.537 3305	22.147 0219	21.766 4771	21.395 4074
32	23.468 3348	23.047 5696	22.637 6742	22.238 3171	21.849 1780
33	23.988 5636	23.547 1918	23.117 5298	22.699 2108	22.291 8809
34	24.498 5917	24.036 4179	23.586 8262	23.149 4123	22.723 7863
35	24.998 6193	24.515 4643	24.045 7958	23.589 1695	23.145 1573
36	25.488 8425	24.984 5428	24.494 6658	24.018 7248	23.556 2511
37	25.969 4534	25.443 8607	24.933 6585	24.438 3148	23.957 3181
38	26.440 6406	25.893 6213	25.362 9912	24.848 1707	24.348 6030
39	26.902 5888	26.334 0233	25.782 8765	25.248 5184	24.730 3444
40	27.354 3792	26.765 2615	26.193 5222	25.639 5784	25.102 7750
41	27.799 4894	27.187 5265	26.595 1317	26.021 5662	25.466 1220
42	28.234 7936	27.601 0052	26.987 9039	26.394 6923	25.820 6068
43	28.661 5623	28.005 8802	27.372 0332	26.759 1622	26.166 4457
44	29.079 9631	28.402 3307	27.747 7097	27.115 1768	26.503 8494
45	29.490 1599	28.790 5319	28.115 1195	27.462 9321	26.833 0239
46	29.892 3136	29.170 6555	28.474 4445	27.802 6199	27.154 1696
47	30.286 5820	29.542 8695	28.825 8626	28.134 4272	27.467 4826
48	30.673 1196	29.907 3385	29.169 5478	28.458 5370	27.773 1537
49	31.052 0780	30.264 2238	29.505 6702	28.775 1277	28.071 3695
50	31.423 6059	30.613 6830	29.834 3963	29.084 3738	28.362 3117
60	34.760 8867	33.732 2993	32.748 9528	31.808 4816	30.908 6565
70	37.498 6193	36.259 5088	35 082 0849	33.962 6772	32.897 8570
80	39.744 5136	38.307 4645	36.949 7808	35.666 1923	34.451 8172
90	41 586 9292	39.967 0508	38.444 8902	37.013 3140	35.665 7685
100	43.098 3516	41.311 9173	39.641 7405	38.078 6036	36.614 1053

TABLE IV.—PRESENT VALUE OF ANNUITY.—(*Continued*)

PRESENT VALUE OF 1 PER ANNUM. $P.\ V.\ A. = \dfrac{1 - \dfrac{1}{(1+i)^n}}{i} = \dfrac{D}{i}$

n	3 %	3½ %	4 %	4¼ %	4½ %
1	.970 8738	.966 1836	.961 5385	.959 2326	.956 9378
2	1.913 4697	1.899 6943	1.886 0947	1.879 3598	1.872 6678
3	2.828 6114	2.801 6370	2.775 0910	2.761 9758	2.748 9644
4	3.717 0984	3.673 0792	3.629 8952	3.608 6099	3.587 5257
5	4.579 7072	4.515 0524	4.451 8223	4.420 7290	4.389 9767
6	5.417 1914	5.328 5530	5.242 1369	5.199 7400	5.157 8725
7	6.230 2830	6.114 5440	6.002 0547	5.946 9928	5.892 7009
8	7.019 6922	6.873 9555	6.732 7449	6.663 7821	6.595 8861
9	7.786 1089	7.607 6865	7.435 3316	7.351 3497	7.268 7905
10	8.530 2028	8.316 6053	8.110 8958	8.010 8870	7.912 7182
11	9.252 6240	9.001 5510	8.760 4767	8.643 5367	8.528 9169
12	9.954 0040	9.663 3343	9.385 0738	9.250 3949	9.118 5808
13	10.634 9553	10.302 7385	9.985 6478	9.832 5131	9.682 8524
14	11.296 0731	10.920 5203	10.563 1229	10.390 8999	10.222 8253
15	11.937 9351	11.517 4109	11.118 3874	10.926 5226	10.739 5457
16	12.561 1020	12.094 1168	11.652 2956	11.440 3095	11.234 0150
17	13.166 1185	12.651 3206	12.165 6688	11.933 1506	11.707 1914
18	13.753 5131	13.189 6817	12.659 2970	12.405 8998	12.159 9918
19	14.323 7991	13.709 8374	13.133 9394	12.859 3764	12.593 2936
20	14.877 4749	14.212 4033	13.590 3263	13.294 3658	13.007 9364
21	15.415 0241	14.697 9742	14.029 1600	13.711 6219	13.404 7239
22	15.936 9166	15.167 1248	14.451 1153	14.111 8675	13.784 4248
23	16.443 6084	15.620 4105	14.856 8417	14.495 7962	14.147 7749
24	16.935 5421	16.058 3676	15.246 9631	14.864 0731	14.495 4784
25	17.413 1477	16.481 5146	15.622 0799	15.217 3363	14.828 2090
26	17.876 8424	16.890 3523	15.982 7692	15.556 1979	15.146 6114
27	18.327 0315	17.285 3645	16.329 5858	15.881 2450	15.451 3028
28	18.764 1082	17.667 0188	16.663 0632	16.193 0407	15.742 8735
29	19.188 4546	18.035 7670	16.983 7146	16.492 1254	16.021 8885
30	19.600 4414	18.392 0454	17.292 0333	16.779 0172	16.288 8885
31	20.000 4285	18.736 2758	17.588 4936	17.054 2131	16.544 3910
32	20.388 7655	19.068 8655	17.873 5515	17.318 1900	16.788 8909
33	20.765 7918	19.390 2082	18.147 6457	17.571 4053	17.022 8621
34	21.131 8367	19.700 6842	18.411 1978	17.814 2977	17.246 7580
35	21.487 2201	20.000 6611	18.664 6132	18.047 2879	17.461 0124
36	21.832 2525	20.290 4938	18.908 2820	18.270 7798	17.666 0406
37	22.167 2354	20.570 5254	19.142 5788	18.485 1605	17.862 2398
38	22.492 4616	20.841 0874	19.367 8642	18.690 8014	18.049 9902
39	22.808 2151	21.102 4999	19.584 4848	18.888 0589	18.229 6557
40	23.114 7720	21.355 0723	19.792 7739	19.077 2747	18.401 5844
41	23.412 4000	21.599 1037	19.993 0518	19.258 7767	18.566 1095
42	23.701 3592	21.834 8828	20.185 6267	19.432 8793	18.723 5498
43	23.981 9021	22.062 6887	20.370 7949	19.599 8843	18.874 2103
44	24.254 2739	22.282 7910	20.548 8413	19.760 0808	19.018 3830
45	24.518 7125	22.495 4503	20.720 0397	19.913 7466	19.156 3474
46	24.775 4491	22.700 9181	20.884 6536	20.061 1478	19.288 3707
47	25.024 7078	22.899 4378	21.042 9361	20.202 5399	19.414 7088
48	25.266 7066	23.091 2442	21.195 1309	20.338 1677	19.535 6065
49	25.501 6569	23.276 5645	21.341 4720	20.468 2664	19.651 2981
50	25.729 7640	23.455 6179	21.482 1846	20.593 0613	19.762 0078
60	27.675 5637	24.944 7341	22.623 4900	21.592 7791	20.638 0220
70	29.123 4214	26 000 3966	23.394 5150	22.252 1303	21.202 1119
80	30.200 7634	26.748 7757	23.915 3918	22.686 9970	21.565 3449
90	31.002 4071	27.279 3156	24.267 2776	22.973 8078	21.799 2408
100	31.598 9053	27.655 4254	24.504 9990	23.162 9702	21.949 8527

TABLE IV.—PRESENT VALUE OF ANNUITY.—(*Continued*)

PRESENT VALUE OF 1 PER ANNUM. $P.\ V.\ A. = \dfrac{1 - \dfrac{1}{(1+i)^n}}{i} = \dfrac{D}{i}$

n	4¾ %	5 %	6 %	7 %	8 %
1	.954 6539	.952 3810	.943 3962	.934 5794	.925 9259
2	1.866 0181	1.859 4104	1.833 3927	1.808 0182	1.783 2648
3	2.736 0554	2.723 2480	2.673 0120	2.624 3160	2.577 0970
4	3.566 6400	3.545 9505	3.465 1056	3.387 2113	3.312 1268
5	4.359 5609	4.329 4767	4.212 3638	4.100 1974	3.992 7100
6	5.116 5259	5.075 6921	4.917 3243	4.766 5397	4.622 8797
7	5.839 1656	5.786 3734	5.582 3814	5.389 2894	5.206 3701
8	6.529 0363	6.463 2128	6.209 7938	5.971 2985	5.746 6389
9	7.187 6242	7.107 8217	6.801 6923	6.515 2322	6.246 8879
10	7.816 3477	7.721 7349	7.360 0870	7.023 5816	6.710 0814
11	8.416 5610	8.306 4142	7.886 8746	7.498 6744	7.138 9643
12	8.989 5571	8.863 2516	8.383 8439	7.942 6863	7.536 0780
13	9.536 5700	9.393 5730	8.852 6830	8.357 6508	7.903 7759
14	10.058 7780	9.898 6409	9.294 9839	8.745 4680	8.244 2370
15	10.557 3060	10.379 6580	9.712 2490	9.107 9140	8.559 4787
16	11.033 2277	10.837 7696	10.105 8953	9.446 6486	8.851 3692
17	11.487 5682	11.274 0662	10.477 2597	9.763 2230	9.121 6381
18	11.921 3062	11.689 5869	10.827 6035	10.059 0869	9.371 8871
19	12.335 3758	12.085 3209	11.158 1165	10.335 5952	9.603 5992
20	12.730 6690	12.462 2103	11.469 9212	10.594 0143	9.818 1474
21	13.108 0372	12.821 1527	11.764 0766	10.835 5273	10.016 8032
22	13.468 2933	13.163 0026	12.041 5817	11.061 2405	10.200 7437
23	13.812 2132	13.488 5739	12.303 3790	11.272 1874	10.371 0590
24	14.140 5376	13.798 6418	12.550 3575	11.469 3340	10.528 7583
25	14.453 9739	14.093 9446	12.783 3562	11.653 5832	10.674 7762
26	14.753 1970	14.375 1853	13.003 1662	11.825 7787	10.809 9780
27	15.038 8516	14.643 0336	13.210 5341	11.986 7090	10.935 1648
28	15.311 5528	14.898 1273	13.406 1643	12.137 1113	11.051 0785
29	15.571 8881	15.141 0736	13.590 7210	12.277 6741	11.158 4060
30	15.820 4183	15.372 4510	13.764 8312	12.409 0412	11.257 7833
31	16.057 6785	15.592 8105	13.929 0860	12.531 8142	11.349 7994
32	16.284 1800	15.802 6767	14.084 0434	12.646 5553	11.434 9994
33	16.500 4105	16.002 5492	14.230 2296	12.753 7900	11.513 8884
34	16.706 8358	16.192 9040	14.368 1411	12.854 0094	11.586 9337
35	16.903 9005	16.374 1943	14.498 2446	12.947 6723	11.654 5682
36	17.092 0291	16.546 8517	14.620 9871	13.035 2078	11.717 1928
37	17.271 6269	16.711 2873	14.736 7803	13.117 0166	11.775 1785
38	17.443 0805	16.867 8927	14.846 0192	13.193 4735	11.828 8690
39	17.606 7595	17.017 0407	14.949 0747	13.264 9285	11.878 5824
40	17.763 0162	17.159 0864	15.046 2969	13.331 7088	11.924 6133
41	17.912 1873	17.294 3680	15.138 0159	13.394 1204	11.967 2346
42	18.054 5941	17.423 2076	15.224 5433	13.452 4490	12.006 6987
43	18.190 5433	17.545 9120	15.306 1729	13.506 9617	12.043 2395
44	18.320 3277	17.662 7733	15.383 1820	13.557 9081	12.077 0736
45	18.444 2269	17.774 0698	15.455 8321	13.605 5216	12.108 4015
46	18.562 5078	17.880 0665	15.524 3699	13.650 0202	12.137 4088
47	18.675 4251	17.981 0157	15.589 0282	13.691 6076	12.164 2674
48	18.783 2221	18.077 1578	15.650 0266	13.730 4744	12.189 1365
49	18.886 1308	18.168 7217	15.707 5723	13.766 7986	12.212 1634
50	18.984 3731	18.255 9255	15.761 8606	13.800 7463	12.233 4846
60	19.752 2689	18.929 2895	16.161 4277	14.039 1812	12.376 5518
70	20.235 0630	19.342 6766	16.384 5439	14.160 3893	12.442 8196
80	20.538 6070	19.596 4605	16.509 1308	14.222 0054	12.473 5144
90	20.729 4523	19.752 2617	16.578 6994	14.253 3279	12.487 7320
100	20.849 4412	19.847 9102	16.617 5462	14.269 2507	12.494 3176

SUMMARY

In Chap. XV, the fundamental principles of actuarial science were given. The following points were emphasized:

The fundamental formulæ are

The amount of \$1 for n periods at i rate of interest $= (1 + i)^n$.

The present value of \$1 for n periods at i rate of interest $= \frac{1}{(1 + i)^n}$.

The annuity of \$1 for n periods at i rate of interest $= \frac{(1 + i)^n - 1}{i}$.

The present value of an annuity of \$1 for n periods at i rate of interest $= \frac{1 - \frac{1}{(1 + i)^n}}{i}$.

With regard to a sinking fund,

$$\text{Sinking fund contribution} = \frac{\text{Amount to be accumulated}}{\frac{(1 + i)^n - 1}{i}}.$$

With regard to amortization,

$$\text{Amortization payment} = \frac{\text{Amount to be accumulated}}{\frac{1 - \frac{1}{(1 + i)^n}}{i}}.$$

With regard to finding the price to be paid for a bond the general expression may be used.

Amount to be paid for bond = (face value of bond) $\times$ (present value of \$1 for number of life periods of bond at desired yield rate) + (periodic interest payment on bond) $\times$ (present value of annuity of \$1 for number of life periods of bond at desired yield rate).

CHAPTER XVI

DEPRECIATION, OBSOLESCENCE, INADEQUACY, AND DEPLETION

OBJECT OF CHAPTER: (*a*) to show the fundamentals underlying the recovery of assets used in a business through its costs; (*b*) to study methods of calculating depreciation; (*c*) to study methods of calculating depletion; (*d*) to show the relation of these factors to the Income Tax laws.

Two Fundamental Problems.

Fundamentally, there are two problems facing industrial executives so far as recovering the investment in fixed assets through costs is concerned.

1. *Depreciation, Obsolescence, and Inadequacy.*—In a manufacturing industry where depreciation, obsolescence, and inadequacy are constantly reducing the value of the investment, it is of the greatest importance to keep this investment intact by recovering, through costs, the constant wasting away which inevitably takes place. The aim is not to replace each piece of property but to keep the original capital tied up in the enterprise the same and to add to it through the earning of suitable profits.

2. *Depletion.*—In the case of mines, timberlands, apartment houses, etc., where it is the purpose of the business to sell the capital assets (depletion of assets), very careful provision must be made to recover through costs the original investment on the *specific property* plus a reasonable return on the investment.

Depreciation a Cost Element.

One of the most difficult problems is the question of depreciation. In studying this question, there are certain fundamental ideas which must be thoroughly understood before going into the many aspects of the problem that modern industry presents.

It is not practical, or permissible, by the government to charge into current costs any estimate of an anticipated future contingency. *Original cost* must be used in calculating depreciation

for cost purposes, and the difference between it and the replacement cost must be provided for by some other means than depreciation. Two points stand out prominently:

1. Depreciation must be calculated on original cost.
2. A certain amount of the company's profit should be reserved in the form of surplus to guard against a probable rise in replacement costs.

Methods of Calculating Depreciation.[1]

Accounting literature outlines many methods of calculating depreciation, some relatively simple and others quite involved Montgomery classifies these methods as follows:

1. Proportional Methods:
   a. Straight-line Method.
   b. Working-hour Method.
   c. Composite-life Method.
   d. Unit-production Method.
2. Variable Percentage Methods:
   a. Fixed Percentage on Diminishing Values Method.
   b. Sum of Expected Life Periods Method.
3. Compound-interest Methods:
   a. Sinking-fund Methods.
   b. Annuity Method.
   c. Unit-cost Method.
4. Miscellaneous Methods:
   a. Maintenance Method.
   b. Appraisal Method.
   c. Gross-earnings Method.
   d. Insurance Method.

Essentially, depreciation is an attempt to evaluate in a monetary way the effect of time and production on buildings, machines, equipment, etc. Any attempt at extreme accuracy, such as a highly mathematical treatment of the subject, is foolish because the various factors affecting depreciation are numerous and their relative importance difficult to estimate. Esquerre, in "Accounting" puts this to us rather clearly when he says: "Depreciation is as difficult to define as its process is difficult to perceive." Newlove gives an excellent definition in a recent article wherein he describes depreciation as: "The cost element caused by the

[1] For a detailed discussion of these methods see MONTGOMERY, "Financial Handbook," pp. 151–155.

decline in the number of useful service units in property," and Cole states it forcibly when he calls depreciation, "hole in assets."[1]

One of the major points brought out by the government accountants is that depreciation is an inescapable cost of doing business, to be provided for by a regular charge to current operations. Hence, it is of paramount importance that the idea be grasped that everything that goes through the factory should bear a proportional cost of depreciation. Depreciation must be charged to current costs.

The government accountants further say:

> Depreciation for cost purposes is not concerned with resale or replacement values, but aims to recover the cost of the asset, less any salvage.

In other words, all methods for calculating depreciation must be based upon *original value.* But, it may aptly be said, a building which cost $30,000 in 1915 will cost $50,000 in 1930. This is very true. The value of the dollar is continually fluctuating and provision for replacing an asset must be provided for. Farsighted directors will care for this by not distributing all of their profits in the form of dividends. By reserving a fair share of their profits in the form of surplus they will be prepared to care for this ever-occurring contingency.

Most Widely Used Methods of Depreciation.

The most widely used of these methods are

1. The Straight Line Method.
2. The Unit Production Method.
3. The Fixed Percentage on Diminishing Value Method.
4. Sinking Fund Method
5. Annuity Method.

Let the specific case of a Gridley Multiple Spindle Automatic Lathe be taken, original cost $3,000, estimated life 10 years, estimated life in productive units 90,000, *i.e.*, the estimated life is 90,000 units of production which the machine will produce before it is worn out, scrap value $300.

[1] Other widely used terms are: "Exhaustion of capacity for service" (Interstate Commerce Commission) and "Expired capital outlay" (P. D. Leake).

The Straight Line Method.

Formula:

$$\text{Depreciation per year} = \frac{\text{Original value} - \text{Scrap value}}{\text{Estimated life in years}} = \frac{\$3{,}000 - \$300}{10} = \$270.$$

Unit Production Method.

Formula:

$$\text{Depreciation cost per unit} = \frac{\text{Original value} - \text{Scrap value}}{\text{Estimated life in productive units}} = \frac{\$3{,}000 - \$300}{90{,}000} = \$.03 \text{ per unit.}$$

If 8,300 units were produced the first year the depreciation per year would be $8{,}300 \times \$.03 = \$249$.

Fixed Percentage on Diminishing Value Method.

Formula:

$$\text{Percentage depreciation per year} = 1 - \sqrt[n]{\frac{\text{Scrap value}}{\text{Original value}}},$$

where

n = life in years.

$$\text{Depreciation per year} = 1 - \sqrt[n]{\frac{300}{3{,}000}} = .20567.$$

Depreciation for the first year $\$3{,}000 \times .20567 = \$617.01$.

Sinking Fund Method.

Formula:

(Interest allowed on fund at 5%.)

$$\text{Sinking-fund contribution for depreciation per year} = \frac{\text{Original value} - \text{Scrap value}}{\text{Amount of an ordinary annuity of \$1 for 10 periods at 5\%}} = \frac{\$3{,}000 - \$300}{12.57789} = \$214.66.$$

(See Chap. 15 p. 283.)

Annuity Method.

Formula:

(Interest allowed at 5% on investment and on fund.)

$$\text{Depreciation per year} = \frac{\text{Original value} - (\text{scrap value} \times \text{present value \$1 at 5\%})}{\text{Present value of an ordinary annuity of \$1 at 5 \%}} = \frac{\$3{,}000 - (\$300 \times .6139)}{7.7217} = \$364.66.$$

Advantages and Disadvantages of the Different Methods.

Straight Line Method.[1]

1. Advantages:
   a. Simplicity of calculation and application.
2. Disadvantages:
   a. Increase burden in later years—depreciation charge a constant while repairs are increasing.
   b. Recovers cost uniformly and hence does not provide a suitable guard against obsolescence.

Unit Production Method.[2]

1. Advantages:
   a. Simplicity of calculation and application.
   b. Particularly applicable to assets producing a uniform product such as machinery and equipment for mines, oil wells, etc.
   c. In the electric public utilities depreciation is often charged on the kilowatt-hour produced.
2. Disadvantages:
   a. In the absence of uniform operation sufficient depreciation will not be charged.

Fixed Percentage on Diminishing Value.[3]

1. Advantages:
   a. A balance between depreciation and repairs. In the earlier years when repairs are low the depreciation charge is high. As time passes and repairs increase, the depreciation charge falls (see schedule page 314).
   b. Recovers cost quickly and hence guards against obsolescence.
2. Disadvantages:
   a. Comparative difficulty in calculation and application.

Sinking Fund Method.

1. Advantages:
   a. May be kept in the form of a fund to replace a specific asset. Quite often depreciation reserves accumulated are invested in other fixed properties and as a result difficulties may be experienced in making suitable replacements.

[1] Government favors this method.
[2] Government favors this method.
[3] Used more widely in England than in America.

2. Disadvantages:
   a. The constantly increasing charge to depreciation is just the *reverse* of what is desirable in regard to repairs (see fixed percentage on diminishing value method). Depreciation charges and repair charges both increase with time (see schedule, page 315).
   b. Difficulty of calculation and application.

Annuity Method.[1]

1. Advantages:
   a. A return in the form of an interest charge on the capital investment.
2. Disadvantages:
   a. Difficulty of calculation.
   b. Equal charges do not guard against obsolescence.
   c. Mixing of interest on the investment with depreciation. (Interest on investment is one of the controversial problems of accounting, and the government will not allow it as a cost.) Lumping interest with depreciation further complicates the problem.

The trend of the times, however, is toward simplicity and while the government will allow the use of any method that gives reasonable values it leans more towards the simpler schemes, such as the straight-line method and the unit-production method.

Depreciation Schedules.[2]

To more fully illustrate these principles, the preceding sample computations may be carried a step further and actual schedules of depreciation may be computed as shown in the following problem.

Problem 1. To Illustrate Principal Methods of Calculating Depreciation and the Building Up of Depreciation Schedules.

A Gridley Multiple-Spindle Automatic Lathe cost the American Manufacturing Company $3,000. It has an estimated life of 10 years and a scrap value of $300.

(1) Prepare depreciation tables and show computations by the following methods, (2) plot a curve for each system using years as abscissa and carrying value as ordinates. For the unit-production method the following is given:

[1] Same effect on costs as straight-line method, see schedule, p. 318.
[2] TONER, J. V., "Mathematics of Finance," pp. 167–187.

Year	Unit Produced
1	8,300
2	10,200
3	10,000
4	10,500
5	9,600
6	9,200
7	9,000
8	8,300
9	7,600
10	7,300
	90,000 units total estimated life.

(*a*) Straight Line.
(*b*) Unit Production.
(*c*) Fixed Percentage on Diminishing Value.
(*d*) Sinking Fund, using 5% interest.
(*e*) Annuity, using 5% interest.

Notation Used in Solving Problems

D = Amount set aside yearly for depreciation.
r = Rate of depreciation.
C = Cost of original value.
S = Scrap value.
n = Life of machine in years.
A = The amount of an annuity of \$1 for n periods at i rate of interest.
p. v. = Present value of \$1 at i rate interest for n periods.
P. V. A. = Present value of an annuity of \$1 for n periods at i rate interest.

Carrying value is the total cost less the total depreciation reserve of that particular date.

(*a*) Straight-line Method

$$D = \frac{C - S}{n} = \frac{\$3{,}000 - \$300}{10} = \$270$$

Year	Debit Depreciation	Credit Reserve	Total Reserve	Carrying Value
				\$3,000
1	\$ 270	\$ 270	\$ 270	2,730
2	270	270	540	2,460
3	270	270	810	2,190
4	270	270	1,080	1,920
5	270	270	1,350	1,650
6	270	270	1,620	1,380
7	270	270	1,890	1,110
8	270	270	2,160	840
9	270	270	2,430	570
10	270	270	2,700	300
	\$2,700	\$2,700		

(*b*) Unit-production Method

$$r = \frac{C - S}{N} = \frac{\$3{,}000 - \$300}{90{,}000} = \$0.030 \text{ per unit}$$

Year	Units of production	Debit Depreciation	Credit Reserve	Total Reserve	Carrying Value
					$3,000
1	8,300	$ 249	$ 249	$ 249	2,751
2	10,200	306	306	555	2,445
3	10,000	300	300	855	2,145
4	10,500	315	315	1,170	1,830
5	9,600	288	288	1,458	1,542
6	9,200	276	276	1,734	1,266
7	9,000	270	270	2,004	996
8	8,300	249	249	2,253	747
9	7,600	228	228	2,481	519
10	7,300	219	219	2,700	300
	90,000	$2,700	$2,700		

(*c*) Fixed Percentage on Diminishing Value

$$r = 1 - \sqrt[n]{\frac{S}{C}}$$

$$= 1 - \sqrt[10]{\frac{\$300}{\$3{,}000}} = 1 - .794333$$

$$= .205667 \text{ or } 20.5667\%$$

Year	Debit Depreciation	Credit Reserve	Total Reserve	Carrying Value
				$3,000.00
1	$ 617.00	$ 617.00	$ 617.00	2,383.00
2	490.10	490.10	1,107.10	1,892.90
3	389.31	389.31	1,496.41	1,503.59
4	309.24	309.24	1,805.65	1,194.35
5	245.64	245.64	2,051.29	948.71
6	195.12	195.12	2,246.41	753.59
7	154.99	154.99	2,401.40	598.60
8	123.11	123.11	2,524.51	475.49
9	97.79	97.79	2,622.30	377.70
10	77.68	77.68	2,699.98	300.02
	$2,699.98	$2,699.98		

Sample Computations

End of first year..... $3,000.00 × .205667 = $617.00
End of second year..... ($3,000.00 − $617.00) × .205667 = $490.10
End of third year..... ($3,000.00 − $1,107.10) × .205667 = $389.31

(*d*) Sinking Fund—Using 5% Interest

$$\text{S. F. C.} = \frac{C - S}{A}, \text{ where } A = 12.57789$$

$$= \frac{\$3{,}000 - \$300}{12.57789}$$

$$= \$214.66$$

Year	Debit Fund (1)	Credit Cash (2)	Credit Interest (3)	Debit Depreciation (4)	Credit Reserve for Depreciation (5)	Total Reserve for Depreciation (6)	Carrying Value (7)
							$3,000.00
1	$ 214.66	214.66		$214.66	$214.66	$ 214.66	2,785.34
2	225.39	$ 214.66	$ 10.73	225.39	225.39	440.05	2,559.95
3	236.66	214.66	22.00	236.66	236.66	676.71	2,323.29
4	248.49	214.66	33.83	248.49	248.49	925.20	2,074.80
5	260.92	214.66	46.26	260.92	260.92	1,186.12	1,813.88
6	273.97	214.66	59.31	273.97	273.97	1,460.09	1,539.90
7	287.66	214.66	73.00	287.66	287.66	1,747.75	1,252.24
8	302.05	214.66	87.39	302.05	302.05	2,049.80	950.19
9	317.15	214.66	102.49	317.15	317.15	2,366.95	633.04
10	333.01	214.66	118.35	333.01	333.01	2,699.96	300.03
	$2,699.96	$2,146.60	$553.36				

Sample Computations

End of first year..... { 214.66 − No Interest
$3,000 − $214.66 = $2,785.34

End of second year..... $214.66 × .05 = $ 10.73
$214.66 + $10.73 = $ 225.39
$214.66 + $225.39 = $ 440.05
$3,000.00 − $440.05 = $2,559.95

End of third year..... $440.05 × .05 = $ 22.00
$214.66 + $22.00 = $ 236.66
$440.05 + $236.66 = $ 676.71
$3,000.00 − $676.71 = $2,323.29

etc.

To more closely visualize the sinking-fund method of charging depreciation, the following diagrammatic set-up of actual book accounts may prove helpful. It will clearly show the ultimate effect upon Profit and Loss. Illustrative entries are made for 3 years.

Assets = Liabilities + Capital

Cash		Income on Sinking Fund		Depreciation	
	$214.66 (1)	(c) $10.73	$10.73 (2)	(1) $214.66	$214.66 (c)[1]
	214.66 (2)	(c) 22.00	22.00 (3)	(2) 225.39	225.39 (c)
	214.66 (3)			(3) 236.66	236.66 (c)

Sinking Fund	
(1)	$214.66
(2)	214.66
(2)	10.73
(3)	214.66
(3)	22.00

Gridley Automatic Lathe	

Reserve for Depreciation Gridley Automatic Lathe	
	$214.66 (1)
	225.39 (2)
	236.66 (3)

Profit and Loss		
For first year	(c) $214.66	
For second year	(c) 225.39	10.73 (c)
For third year	(c) 236.66	22.00 (c)

[1] (c) means closing entry.

A simpler method of setting up a sinking fund schedule, using the same illustration is shown in the following table. It will be noted that columns (1), (3), (2), (6) and (7) of the previous illustration are used. Columns (4) Debit Depreciation and Column (5) Credit Reserve for Depreciation are the same as Column (1) and hence may be omitted.

(*d*) SINKING FUND—USING 5% INTEREST.—(*Continued*)

$$\text{S. F. C.} = \frac{C - S}{A}, \text{ where } A = 12.57789$$

$$= \frac{\$3{,}000 - \$300}{12.57789}$$

$$= \$214.66$$

Year	Debit Fund (1)	Credit Interest (3)	Credit Cash (2)	Total Reserve for Depreciation (6)	Carrying Value (7)
					$3,000.00
1	$ 214.66		$ 214.66	$ 214.66	2,785.34
2	225.39	$ 10.73	214.66	440.05	2,559.95
3	236.66	22.00	214.66	676.71	2,323.29
4	248.49	33.83	214.66	925.20	2,074.80
5	260.92	46.26	214.66	1,186.12	1,813.88
6	273.97	59.31	214.66	1,460.09	1,539.90
7	287.66	73.00	214.66	1,747.75	1,252.24
8	302.05	87.39	214.66	2,049.80	950.19
9	317.15	102.49	214.66	2,366.95	633.04
10	333.01	118.35	214.66	2,699.96	300.03
	$2,699.96	$553.36	$2,146.60		

(*e*) Annuity—Using 5% Interest

$$D = \frac{C - (S \times \text{p. v.})}{\text{P. V. A.}}$$

$$= \frac{\$3{,}000 - (\$300 \times .61391325)}{7.7217349}$$

$$= \frac{\$3{,}000 - \$184.174}{7.7217349}$$

$$= \$364.66$$

Year	Debit Depreciation	Credit Interest 5% of Carrying Value	Credit Reserve	Total Reserve	Carrying Value
					$3,000.00
1	$ 364.66	$150.00	$ 214.66	$ 214.66	2,785.34
2	364.66	139.27	225.39	440.05	2,559.95
3	364.66	128.00	236.66	676.71	2,323.29
4	364.66	116.16	248.50	925.21	2,074.79
5	364.66	103.74	260.92	1,186.13	1,813.87
6	364.66	90.69	273.97	1,460.10	1,539.90
7	364.66	77.00	287.66	1,747.76	1,252.24
8	364.66	62.61	302.05	2,049.81	950.19
9	364.66	47.51	317.15	2,366.96	633.04
10	364.66	31.65	333.01	2,699.97	300.03
	$3,646.60	$946.63	$2,699.97		

Sample Computations

End of first year.....$3,000.00 × .05 = $ 150.00 interest
$ 364.66 − $150.00 = $ 214.66
$3,000.00 − $214.66 = $2,785.34

End of second year.....$2,785.34 × .05 = $ 139.27
$ 364.66 − $139.27 = $ 225.39
$2,785.34 − $225.39 = $2,559.95

etc.

A set of accounts similar to those of the sinking fund, may be set up for the annuity method. It should be noted that in this method, depreciation, a debit is offset by two credits namely Reserve for Depreciation and Interest on Carrying Value.

Assets = Liabilities + Capital

	Income		Outgo	
	Interest on Carrying Value		Depreciation	
	(*c*) $150.00	$150.00 (1)	(1) $364.66	364.66 (*c*)[1]
Gridley Automatic	(*c*) 139.27	139.27 (2)	(2) 364.66	364.66 (*c*)
Lathe	(*c*) 128.00	128.00 (3)	(3) 364.66	364.66 (*c*)

Reserve for Depreciation Gridley Automatic Lathe	
	$214.66 (1)
	225.39 (2)
	236.66 (3)

Profit and Loss			
For first year	(*c*)	$364.66	$150.00 (*c*)
For second year	(*c*)	$364.66	$139.27 (*c*)
For third year	(*c*)	$364.66	$128.00 (*c*)

[1] *c* means closing entry.

Depreciation Curves.

The curves shown in Fig. 59 graphically illustrate the methods of depreciation studied.

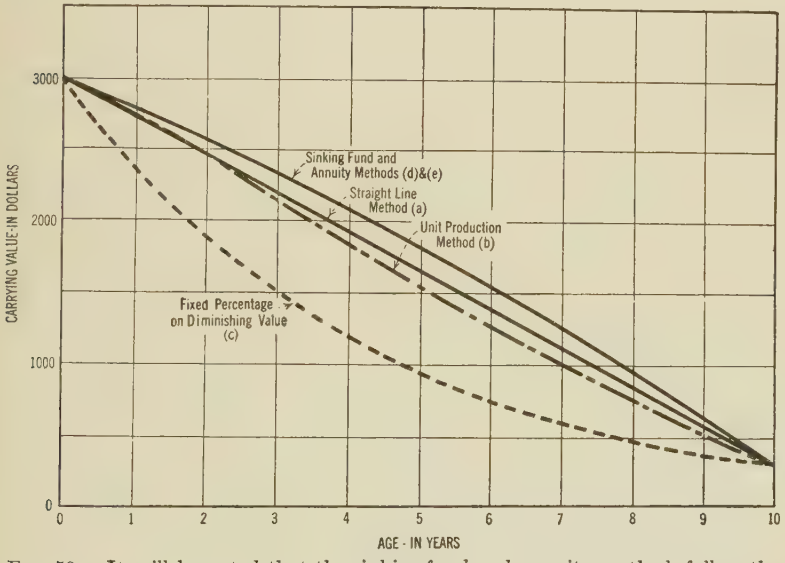


FIG. 59.—It will be noted that the sinking fund and annuity methods follow the same curves. This is because the carrying value is the same in both cases.

Recording Depreciation.

The government advises that "Depreciation should be adequately recorded." The "Plant" or "Property ledger," (see Fig. 60) a volume containing a page for each building, piece of machinery

or equipment, is most highly recommended. A complete record and history of depreciation can be secured in this way. To illustrate the use of the Plant ledger, let it be assumed a Gridley

PAGE OF A PLANT LEDGER

Machine—Gridley Multiple Spindle Automatic Lathe	Location Floor 1 Row 2 Number 37
Maker National Acme Company	Cost $2,750. Freight $50
Purchased Jan. 1, 1920.	Estimated Useful Life as of 1/1/26–6 years as of 1/1/20–10 years.
New or Second hand—New	Probable Selling Value $300.
Weight 3,500 lbs.	Method of Depreciation—Straight Line

Date	Description Remarks	Total Cost	Scrap Value	Wearing Value	Annual Depreciation	Depreciation Reserve	Remaining Value
1920 Jan. 1	Invoice	$ 2,750					
	Freight	50					
	Installation	200	300	2,700	270	270	2,430
1921		3,000			270	540	2,160
1922					270	810	1,890
1923					270	1,080	1,620
Sept. 8	Motor Installed	750		750			750
1924		3,750		3,450	395	1,475	2,370 1,975
1925					395	1,870	1,580
Nov. 11	Thoroughly repaired					200	200
1926					296 67	1,670 1,966 67	1,780 1,483 33
1927					296 67	2,263 34	1,186 66
1928 Jan. 15	Sold Lathe—$1,000. Loss $486.66						

FIG. 60.

Multiple Spindle Automatic is purchased for use in the automatic department of an automobile plant. The machine is number 37, which symbol is attached permanently to it. The machine's location is on the first floor, second row. The useful life of an automatic may be conservatively estimated at 10 years. The cost

at which the machine is to be carried, as of Jan. 1, 1920, is invoice cost, $2,750, plus freight cost, $50, plus installation cost $200, equaling $3,000. The scrap value is estimated at $300 leaving a wearing value of $2,700 and an annual depreciation of $270 by the straight-line method found by dividing $2,700 by the useful life of 10 years.

The term "remaining value" is used by the government, and is the value obtained by subtracting from the total cost the sum of the scrap value and the total depreciation reserve. It is carrying value as previously used less scrap value.

The record of the lathe is as follows:[1]

1920. Normal depreciation of $270, no additions, no renewals. At the end of the year, 1920, there was $270 in the depreciation reserve, and a net remaining value of $2,430. (Wearing value $2,700 less depreciation $270.)

1921. Normal depreciation of $270. No additions, no renewals. At the end of the year there was $540 in the depreciation reserve, and a net remaining value of $2,160.

1922. Normal depreciation of $270. No additions, no renewals. At the end of the year there was $810 in the depreciation reserve, and a net remaining value of $1,890.

1923. Normal depreciation of $270. No renewals. A motor was installed Sept. 8, 1923 at a cost of $750. At the end of the year there was $1,080 in the depreciation reserve and a remaining value of $1,620. The former wearing value of $2,700 has been increased $750 to $3,450, by the cost of the motor. $3,450 less $1,080 in depreciation reserve, leaves a net wearing value of $2,370.

1924. The normal depreciation has been increased to $395. This is obtained by dividing the new remaining value $2,370 by the remaining useful life of 6 years. No additions, no renewals. There was at the end of the year $1,475 in the depreciation reserve, and a net remaining value of $1,975.

1925. Normal depreciation of $395. There would be $1,870 in the depreciation reserve at the end of the year, and a net remaining value of $1,580, but, on Nov. 11, the machine was thoroughly repaired at a cost of $200. This $200 is charged against the accumulated depreciation, reducing that to $1,670 and increasing the remaining value by just that much to $1,780.

1926. Jan. 1, 1926, the machine had been in use 6 years. Its remaining useful life accordingly would be 4 years, but, because of the repair-

[1] See "Depreciation—Treatment in Production Costs," Chamber of Commerce of U. S., Washington, D. C.

ing, it is estimated that the life of the machine has been increased 2 years. The remaining useful life of the machine is correspondingly changed to 6 years. The remaining useful life, 6 years, divided into the remaining value, $1,780 gives a new annual depreciation charge of $296.67. At the close of the year, the depreciation in reserve amounted to $1,966.67, and the remaining value $1,483.33.

1927. Normal depreciation of $296.67. No additions, no renewals. At the end of the year there was $2,263.34 in depreciation reserve and a net remaining value of $1,186.66.

1928. On Jan. 15, the machine was sold for $1,000. On the proper page of the journal an entry corresponding to the following will appear:

Cash	$1,000.00	
Reserve for Depreciation	2,263.34	
Profit and Loss	486.66	
Machinery		$3,750.00

This journal entry is frequently referred to as a journal entry to "wipe an asset off the books."

The sales price, $1,000, plus the accumulated depreciation, $2,263.34, equals $3,263.34, deducted from the total cost, $3,750, indicates a loss of $486.66 on the transaction.

A notation can be written in red ink across the face of the Property Ledger page, or the items of cost, scrap and wearing value, depreciation reserve and remaining value closed out. At all events, the page will be taken out and filed in the rear of the ledger.

Additions and Repairs Usually Charged to Expense.

In the preceding problem several unusual points were illustrated. In most cases, *small* additions and *ordinary* repairs are charged directly into the expense of the current period. There are exceptions to this practice, however, as illustrated in the plant-ledger problem. It was considered that the addition of a $750 motor on Sept. 8, 1923, was a major improvement, and its value was therefore added to the original value of the machine.

The same line of reasoning leads us to believe that a major repair item such as occurred on Nov. 11, 1925, offsets the depreciation to the value of $200 and increases the life of the machine for 2 years.

Great care must be exercised, however, in matters of this sort. The most widely prevailing practice being *to charge repairs directly to current expense.*

The following notations by G. H. Newlove, in the *Journal of Accountancy*, December, 1928, will enable the reader to guard against certain misconceptions concerning depreciation.

Guards against Misconceptions Concerning Depreciation.

Depreciation Not Reservation of Profits.—The idea that depreciation is something taken out of profits is not only misleading but dangerous. Published corporate reports and prospectuses are full of this misconception of depreciation. Playing upon the loose ideas concerning depreciation in the minds of the public, a company (capital stock $100,000, annual depreciation $25,000, profits before deducting depreciation $40,000) will announce a net profit of $40,000 available for depreciation and dividends. This half-truth makes the company appear to be earning 40% when it really is making only 15%. Or the same company (assume $200,000 prospective issue of 5% bonds) will announce that the net earnings available for interest on these bonds and depreciation have been 4 times the interest on this bond issue. This half-truth conceals the fact that the true net profits were only 1.5 times the interest charges.

Depreciation Not Sum of Money.—The close association of the idea of depreciation and that of the replacement of the depreciated assets has sometimes caused depreciation to be spoken of as a replacement fund. This is absolutely incorrect, because depreciation is the cost of service rendered, an expense rather than an asset. The two concepts must be differentiated because depreciation exists whether or not cash is set aside to replace the asset when it is scrapped.

Depreciation Not Provision for Replacement.—The idea of depreciation must not be confused with the general subject of property replacement. True, depreciation is one of the causes of replacement, but depreciation is a cost of operation entirely independent of the owners' financial policy regarding replacements. The owners of an apartment house suffer by depreciation even though they do not intend to replace the building when it is no longer usable. Few producers want their plants exactly replaced but all amortize their present equipment.

Depreciation is the amortization of present property and is not the acquisition of the future property. Whether the future property will cost more or less than the cost or present value of the present property does not necessarily affect the depreciation of the present property. Suppose that an asset was purchased in a period of constantly rising prices (cost 100, present value 120, replacement cost 135). It is open to question whether the annual depreciation charges should be based on the cost or present value, but it is illogical to use the replacement cost as the base. The decline in the number of service units in present property cannot be valued in terms of the cost of buying future property. To amortize property at its replacement value can be logically defended

only if the replacement value coincides with either the cost value or the present value. It is unfortunate that the advocates of basing depreciation on a valuation other than original cost do not speak of present reproduction (appraised) values instead of replacement costs. In misstating their basis, they greatly weaken their position.

Depreciation Not Financial Loss.—The charge for depreciation is made because of service rendered by the property and not because of any financial policy. The charge for depreciation is, therefore, not a financial loss but is part of the overhead of the department in which the service is rendered.

Depreciation Not Decline in Efficiency.—The difference between depreciation and decline in efficiency can be clearly seen in the case of the famous "one-hoss shay" which maintained its efficiency but not the number of its prospective service units right up to its calamitous end. Depreciation is the decline in the number of useful service units; efficiency is the relative excellence of the performance of these service units. This distinction is vitally important, because many producers believe that adequate repair programmes which maintain the efficiency of their plants enable them to ignore depreciation. It is well to remember Hatfield's (*"Accounting"*) apt words: "All machinery is on an irresistible march to the junk heap, and its progress, while it may be delayed, can not be prevented by repairs."

Depreciation Not Decline in Exchange Value.—To speak of depreciation as "shrinkage in value due to wear and tear, etc." is unfortunate, because so frequently appreciation more than equals depreciation. No one denies that the Hudson River is flowing to the ocean simply because at high tide more water is coming into the river bed than is going out of it. Similarly, no one can deny that a machine is marching to the junk heap simply because the vagaries of price levels may have caused a net rise in its market value. The result of the high tide is to increase the flow at ebb tide; the result of the appreciation is to increase the diminution of value in the subsequent periods.

Depreciation can not be offset by appreciation because (*a*) depreciation is an operating cost and appreciation is an unrealized profit, and (*b*) depreciation is a deduction for tax purposes and appreciation is not a taxable income.

Depreciation Not Deterioration.—Depreciation, which is a financial result, must not be confused with deterioration, which is a physical condition. Deterioration is only one of the causes of the loss of service life or depreciation.

Depreciation Not Obsolescence.—Depreciation, the financial result of the decline in the number of useful service units in property, is not synonymous with obsolescence, an economic process which causes depreciation by attacking the utility of the remaining service units in property. The classic example of obsolescence was the supplanting of the horse-

cars by the power-driven street cars. Obsolescence does not cause loss of service life from a physical but from an economic point of view.

Depreciation Not Inadequacy.—Inadequacy is an economic process which attacks the utility of the service units in property. The economic process, inadequacy, is one of the causes of the financial effect, depreciation. The most frequently seen examples of inadequacy are the supersessions of small water and gas mains by larger mains in rapidly growing urban communities. Inadequacy does not physically affect the mains, but renders it an engineering economy to replace them.

Depreciation Not Depletion.—Depletion is the physical diminution of property. *Depletion reduces the physical life of property, depreciation the service life.* The word "depletion" should be limited in accounting terminology to exhaustion in the extractive industries, oil and gas wells, timber trade, and mines. Depletion through the exhaustion of the natural wealth may cause depreciation of property used in the extracting process. A saw mill having a natural life of 50 years has a service life of 30 years, if the standing timber will be cut in that time.

The Effects of Obsolescence and Inadequacy—When Shall an Old Machine Be Scrapped and a New One Purchased?

Obsolescence, the economic factor, and inadequacy, the physical factor, are constantly reducing the value of assets. A machine will become obsolete because other machines very materially improve on its performance and the firm can not afford to run the old one and compete with other companies using new machines.

A machine will become inadequate because it can no longer handle the size of products the company makes. It is perfectly good, but it is a dead weight on the company's hands so far as operation is concerned.

These two factors are constantly arising in modern industry and the executive continually faces the problem of "to scrap or not to scrap."

Most companies will agree to scrap a machine provided the new machine *will pay for itself* in, say, 2 years. There does not seem to be a clear understanding, however, as to just what is meant by the phrase "pay for itself."

Certain questions arise. What is to become of the undepreciated value of the old machine? Shall it be charged directly to Profit and Loss for the period in which it was scrapped, or shall it be recovered as part of the savings of the new machine?

"Pay for itself" may mean bringing about savings which will result in a recovery of (1) original cost of new machine in a certain number of years, or (2) original cost of new machine plus undepreciated value of old machine in a certain number of years.

A recent survey by L. P. Alford of *Manufacturing Industries* of a number of prominent industries showed that slightly over 85% charged undepreciated value directly to Profit and Loss.[1]

The controller of one company says:

> When we charge off the value of junked machinery, we charge it directly to our Profit and Loss account less the scrap or resale value. In all cases when the machines are "junked," they are replaced with similar machines and we do not believe it good policy to spread the loss on the junked machines over our product. We consider it as a capital loss and handle it on our books accordingly.

Another executive says:

> We do not consider it right to charge this difference against future operations with which the discarded equipment has nothing to do.

Some companies adopt the second point of view, namely, that the new machine should save its own cost plus the undepreciated value of the old machine. There are several formulæ which give the number of years required to bring about the necessary savings. The following formula by R. M. Barnes, from *Factory and Industrial Management*, June, 1928, is illustrative of this method of thought.

Let

X = The number of years in which the equipment will pay for itself.
A = The cost of the new equipment (with all necessary tools and fixtures) installed in the plant.
B = The present book value, less salvage value, of the equipment which will be replaced.
C = The interest charge on the new equipment at 6%.
D = The number of pieces to be produced per day by the new equipment.
E = The present labor cost per piece (present piece rate).
F = The estimated labor cost per piece (estimated piece rate).
G = Estimated number of working days in the year that the new equipment will be used.
H = Savings (or losses, plus or minus) in operating cost, overhead and fixed charges per year, other than interest.

[1] Alford, L. P. Representative Policies and Methods for Purchasing New Equipment; a series of articles beginning October, 1927, p. 277, in *Manufacturing Industries Magazine.*

Then

$$X = \frac{A + B}{(E - F)DG + H + C}.$$

Problem 2.

At the present time, there are 10 hand-operated machines working on the same operation. Ten operators have an average daily output of 250 pieces each. The piece rate is \$.03 per piece. It is estimated that two automatic machines will produce 2,500 pieces per day and that two men would be required to tend these machines. The new estimated piece rate will be \$.004 per piece. The new machines will cost \$5,200 each, installed, and the old equipment has a book value, less recovery value, of \$9,000. It is estimated that the machines will be in operation 90% of the time or 270 days of the year. The estimated savings in overhead, operating cost, and so forth, will be \$1,500. So the data might be tabulated in the following way:

$A = \$5{,}200 \times 2 = \$10{,}400.$
$B = \$900 \times 10 = \$9{,}000.$
$C = 10{,}400 \times 0.06 = \$624.$
$D = 2{,}500.$
$E = \$.03.$
$F = \$.004.$
$G = 300 \times 0.90 = 270.$
$H = \$1{,}500.$

Then

$$X = \frac{\$10{,}400 + \$9{,}000}{(.03 - .004)2{,}500 \times 270 + 1{,}500 + 624} = 1 \text{ year.}$$

Another method by capitalizing the operating cost is very aptly illustrated by J. J. Berliner, Senior Member, National Accounting Systems, in *Factory and Industrial Management*, April, 1928.

Should the old machine stay in operation, or should it be scrapped and replaced by the improved machine?

To answer this problem, there are two elements entering into the cost of production to consider: (1) the unrecovered investment; (2) the operating costs, which consist of items such as power, labor, and so on. By "unrecovered investment" is meant the original cost of the machine, less the actual depreciation. In the case of the old machine, the unrecovered investment is determined in this way:

Cost of Old Machine	\$2,400.00
Estimated Scrap Value at End of 6 Years	\$ 100.00
Amount to Be Depreciated over Life of Machine	\$2,300.00
Depreciation for 1 Year (\$2,300 ÷ 6) =	\$ 383.33
Depreciation to Date (3 Years)	\$1,150.00
Operating Expense per Year, Old Machine	\$2,100.00
Cost of New Machine	\$4,000.00
Operating Expense per Year, New Machine	\$1,600.00

If money is worth 6%, the capital cost of operating the old machine is

$$\$2,100 \div .06 = \$35,000.$$

That is, if the operating expenses are capitalized, it is equivalent to a capital investment of $35,000. On the other hand, the capitalized cost of operating the new machine is

$$\$1,600 \div .06 = \$26,666.67.$$

Adding the capitalized operating costs, we have the following:

Old Machine

Original Cost, Less Depreciation	$ 1,250.00
Capitalized Operating Cost	$35,000.00
Total Capitalized Cost	$36,250.00

New Machine

Original Cost	$ 4,000.00
Capitalized Operating Cost	$26,666.67
Total Capitalized Cost	$30,666.67

From the above illustration, it is evident that a substantial saving would result if the old machine were scrapped. If we scrapped the old machine, our loss on the old machine would be ($1,250, less scrap value $100) $1,150. Adding this loss to the total capitalized cost of the new machine would give the final capitalized cost of $30,666.67, plus $1,150 or $31,816.67 as compared with the total for the old machine of $36,250. By scrapping the old machine, there would be a saving of $36,250 less $31,816.67 or $4,433.33.

Mr. Alford's survey, however, showed two things very clearly. Most companies charge the undepreciated value of old machines directly to Profit and Loss and under such procedure expect the new machine to pay for itself in 2 years.

Depletion.

The second fundamental of recovering original investment through costs is brought about in such industries as mining and timberlands where it is the intention of the management to distribute or sell its capital assets.

An apartment house or a hotel may offer a similar condition and after, say, 30 years the owners should be able to scrap it and have recovered their original investment plus a reasonable profit. Such assets are frequently called "wasting assets" because their

life cannot be restored through replacement or prolonged through repairs or renewals.

It becomes necessary for the management to create a sinking fund to return the original investment at the end of the estimated life of the asset.

Valuation of Mines, Timberlands, Etc.

In case of permanent assets, the present value is determined by dividing the income by the income rate desired, expressed thus: Present value of permanent asset $= R/i'$, R being the annual income, i', the interest return on the investment.

When, however, the asset possesses limited life, provision must be made against the time when the rent or income will cease. Value in this case means *present value* based on *two different rates* of interest. Since the asset possesses a limited life, provision must be made against the time when the rent or income will cease. To accomplish this, a sinking fund must be set up to pay back the original investment. Interest must also be allowed upon the investment at a reasonable business rate.

Algebraic Expression for Present Value of a Wasting Asset. Present value of wasting assets $=$

$$\frac{R}{i' + \frac{1}{A} \text{ (for } n \text{ periods at } i \text{ rate of interest)}}$$

where

i' is the interest rate upon the investment, A is the amount of an ordinary annuity for n periods at i rate of interest.

This expression may be developed as follows:[1] The net annual income R is usually arrived at by engineering estimates or appraisals. This net annual income should, to take care of the ever-reducing nature of the asset, be divided into two parts; (1) the amount to be put into a sinking fund to recover the original investment, and (2) a reasonable rate of return on the investment.

If R is the net annual income, P. V. the present value of a wasting asset, i' the interest return on the investment, and i the interest rate at which the sinking fund accumulates, then

$$\text{The interest on the investment} = \text{P. V. } i',$$
$$\text{The sinking fund payment} = R - \text{P. V. } i'.$$

[1] TONER, "Mathematics of Finance."

The sum of the sinking-fund payments must, at the end of n years, the estimated life of the wasting asset, equal its original value P. V. The sum is the amount A of an ordinary annuity of n payments at i rate of interest.

Algebraically, this may be expressed as

$$(R - \text{P. V. } i')A = \text{P. V.}$$

or

$$R\,A - \text{P. V. } i'A = \text{P. V.}$$
$$\text{P. V.} + \text{P. V. } i'A = RA$$
$$\text{P. V.}(1 + i'A) = RA$$
$$\text{P. V.} = \frac{RA}{1 + i'A} = \frac{R}{\frac{1}{A} + i'} = \frac{R}{i' + \frac{1}{A}}.$$

Problem 3. Valuation of Mines Illustrated.

A mine will produce a net income of $30,000 a year for 40 years. Determine its value if the annual dividend rate is to be 7% payable annually and the sinking fund is to accumulate at 4%, interest annually.

By formula (A for 40 periods at 4% = 95.0255157),

$$\text{Present value of mine} = \frac{R}{i' + \frac{1}{A}} = \frac{\$30{,}000}{.07 + \frac{1}{95.0255157}} = \frac{\$30{,}000}{.07 + .01052349}$$
$$= \$372{,}561.60.$$

Dividend payment.... $372,561.60 × .07 = $26,079.3120 per year.
Sinking-fund payment $372,561.60 × .01052349 = $3,920.6880 per year.

Problem 4.

An apartment house will earn for its owners an estimated income of $35,000 per year. The proprietor feels that he should earn 8% on his money, and, to protect his original investment, will make annual deposits into a sinking fund earning interest at 4% per year, compounded annually. The life of the apartment house is estimated as 30 years.

Required:

Price to be paid for apartment house;
Proprietor's earnings per year;
Sinking-fund payment per year.

(A for 30 periods at 4% = $56.0849378)

$$\text{Present value of apartment house} = \frac{\$35{,}000}{.08 + \frac{1}{A}} = \frac{\$35{,}000}{.08 + \frac{1}{56.0849378}}$$
$$= \frac{\$35{,}000}{.08 + .01783009} = \$357{,}763.14.$$

Dividend payment.... $357,763.14 × .08 = $28,621.05 per year.
Sinking-fund payment $357,763.14 × .01783009 = $6,378.95 per year.

U. S. Treasury Table for Determining Value of Wasting Assets.

The number of such problems of evaluation has naturally brought about the use of tables for evaluating wasting assets. Table I, page 332, is a modified form of Hoskold's table and is used by engineers in the Natural Resources Division of the Treasury Department. It will be noted that the columns are headed at the yield rate, but the factors themselves included a redemption rate of 4%. The values are calculated by the expression,

$$\frac{\text{P. V.}}{n} = \frac{1}{\dfrac{ni}{(1+i)^n - 1} + ni'} = \frac{1}{\dfrac{n}{A} + ni'}.$$

Derived from Hoskold's formula. Present value of \$1 per annum in n years, interest on capital being at one rate i', and for redemption another rate i%.

If this expression is divided through by n, the following previously developed expression is obtained

$$\text{Present value of wasting assets} = \frac{1}{\dfrac{i}{(1+i)^n - i'} + i'} = \frac{1}{\dfrac{1}{A} + i'}.$$

This table records factors which when multiplied by the *total* estimated income will give the valuation of the property being appraised.

Thus in Problem 1. From the table in the 7% column opposite 40 years the figure .310468 is obtained. The value of the mine then is

$$\$30{,}000 \times 40 \times 0.310468 = \$372{,}561.60.$$

In Problem 2. From the table in the 8% column opposite 30 years, .340726 is given. The value of the apartment house then is

$$\$35{,}000 \times 30 \times 0.340726 = \$357{,}763.14.$$

The following problem from Sailer's "Accountant's Handbook," page 466, further illustrates the use of the Valuation table.

TABLE BASED ON HOSKOLD'S FORMULA
(Rate of 4% Interest, Compounded Annually, Allowed on Sinking Fund)

Years	6%	7%	8%	9%	10%	12%	15%
1	.943396	.934579	.925925	.917431	.909090	.892857	.869565
2	.908766	.892946	.876891	.861777	.847176	.819408	.781010
3	.876389	.853937	.832607	.812317	.792993	.756976	.708694
4	.846052	.818370	.792418	.768072	.745178	.703254	.648525
5	.817570	.785469	.755780	.728260	.702675	.656540	.597680
6	.790781	.754961	.722245	.692177	.664641	.615547	.554148
7	.765540	.726638	.691435	.659519	.630410	.579284	.516457
8	.741717	.700174	.663032	.629635	.599440	.546979	.483587
9	.719198	.675487	.636765	.602251	.571286	.518017	.454455
10	.697880	.652354	.612404	.577066	.545581	.491906	.428649
11	.677672	.630699	.589748	.553820	.522019	.468244	.405574
12	.658489	.610277	.568624	.532281	.500344	.446702	.384818
13	.640258	.591066	.548887	.512330	.480337	.427009	.366049
14	.622911	.572950	.530401	.493737	.461815	.408936	.348995
15	.606385	.555828	.513053	.476390	.444619	.392292	.333431
16	.590625	.539630	.496741	.460167	.428610	.376914	.319170
17	.575581	.524283	.481376	.444963	.413671	.362663	.306056
18	.561205	.509716	.466880	.430685	.399699	.349420	.293955
19	.547455	.496371	.453178	.417253	.386603	.337082	.282754
20	.534292	.482719	.440211	.404592	.374302	.325559	.272358
21	.521680	.470171	.427920	.392637	.362729	.314474	.262682
22	.509587	.458216	.416255	.381334	.351818	.304658	.253654
23	.497979	.446805	.405166	.370630	.341517		
24	.486835	.435903	.394619	.360479	.331775		
25	.476122	.425477	.384571	.350840	.322549		
26	.465820	.415496	.374988	.341675	.313799		
27	.455905	.405933	.365839	.332951	.305488		
28	.446356	.396767	.357096	.324637	.297587		
29	.437155	.387970	.348734	.316704	.290063		
30	.428283	.379520	.340726	.309127	.282893		
31	.419724	.371399	.333054				
32	.411462	.363589	.325695				
33	.403483	.356072	.318631				
34	.395772	.348832	.311840				
35	.388318	.341856	.305324				
36	.381108	.335128	.299049				
37	.374130	.328637	.293009				
38	.367375	.322371	.287190				
39	.360832	.316318	.281581				
40	.354491	.310468	.276171				

Problem 5. Wasting Assets Illustrated.

Copy of memorandum prepared by Metal Valuation Section of the Income Tax Bureau in determining valuation of a mine, Mar. 1, 1913.

Ore Reserves, Mar. 1, 1913	875,000 tons
Gross Value, Mar. 1, 1913 (875,000 × $12.78)	$11,182,500
Selling price of metal in ore reserves — actual or anticipated.	
Gross Cost Mar. 1, 1913 (875,000 × $7.1537)	6,259,489
Cost of mining and extracting metal in ore reserves — actual or anticipated and exclusive of depletion and of depreciation of plant.	
Art. 206 of Reg. 62 defines such "cost" as comprising all current expenses of producing, preparing, and marketing the mineral product sold, exclusive of federal income and profits taxes, allowable capital additions as defined in Art. 222 of Reg. 62, and deductions for depreciation and depletion, but including cost of repairs and replacements necessary to maintain the plant and equipment at its rated capacity and efficiency.	
Net Returns (actual or anticipated)	$ 4,923,013
Present Worth (discounting at 15% and 4%, using 8-year life).	
Present Worth is inclusive cost of plant and is based on earnings on capital or purchase price at the rate of 15% per annum and making payments into a sinking fund which at 4%, compounded annually, will provide for the return of capital at end of 8-year life.	
The above table is calculated for the investment of a sinking fund at 4%, the variables being the rate of discount on capital and the years of life. From the table we find that the present value of each dollar of operating profit accumulated during the life is .483507.	
Present Worth, therefore, is $4,923,013 × .483507	$ 2,380,311
Deduct Cost of Plant (actual or prospective)	$ 1,000,000
The treasury deducts the full cost (actual or prospective) of the plant from the Mar. 1, 1913, present value of the mine on the assumption that the plant must be constructed and the full investment therefore made at the beginning of the period during which the ore is to be removed. If the plant had been constructed prior to Mar. 1, 1913, its value at that date would be deducted.	
Market Value of Ore *en bloc* Mar. 1, 1913	$ 1,380,311
Unit of Depletion per Ton ($1,380,311 ÷ 875,000 tons)	$ 1.5775

CONSIDERATION OF DEPRECIATION, OBSOLESCENCE AND DEPLETION WITH REFERENCE TO THE INCOME TAX

Depreciation and Obsolescence Deductions.

The income tax law allows the deduction of a reasonable amount for depreciation and obsolescence. The purpose of such an allowance is to permit the taxpayer to get back his capital by the time the asset has worn out. Amounts making good wear and tear also cannot be deducted.

In computing depreciation, the basis is generally cost. Where property is acquired after Feb. 28, 1913, the basis is cost; if acquired before that date, either *the cost* or the *Mar.* 1, 1913, *value* is used.

As pointed out earlier in this chapter, the government will allow the use of any reasonable method of depreciation although only two methods are specifically recognized, namely, the straight-line method and the production method. It is further recognized that no general statement of depreciation rates can be given which will apply to all cases. Each case must usually be considered independently.

The depreciation rate should include in its estimate a reasonable allowance for obsolescence which is likely to take place within the particular industry. To be deductable, however, depreciation *must be adequately recorded on the taxpayers' books.*

Depletion Deductions.

Depletion deductions are based on the sale value of the property. Where property is acquired after Feb. 28, 1913, this will usually be the cost of the property. If acquired before that date, the basis of evaluation will usually be the cost or Mar. 1, 1913, value.

The depletion allowance may be computed by the simple expression,

$$\frac{\text{Cost or valuation as of a certain date}}{\text{Mineral or other content as of same date}} \times \text{Output for the taxable year (see Problem 5, p. 333).}$$

In the depletion of oil and gas wells under the new law, the computation is simplified so that the allowance may be $27\frac{1}{2}\%$ of the gross income from the property during the taxable year.

Valuation is essentially an engineering problem, particularly the estimate of the contents of a mine or of oil and gas wells.

Depletion must be recorded on the books in the same manner as depreciation.

REPRESENTATIVE PROBLEMS ON DEPRECIATION, OBSOLESCENCE AND DEPLETION WITH REFERENCE TO THE INCOME TAX[1]

Calculate the deduction for income tax purpose in each of the following cases:

Depreciation.

Problem 6.

The J. B. Rex Company built a factory building, in 1915, for $40,000. The estimated life is 30 years and the estimated scrap value, $4,000.

Solution.

$$\frac{1}{30} = 3\frac{1}{3}\%$$

($40,000 − $4,000) × .03⅓ = $1,200 the annual depreciation deduction.

Problem 7.

The Boswell-Jones Gear Company bought two Bullard Mult-Au-Matics at a cost of $40,000 with an estimated life of 10 years, salvage value $2,000. At the end of 3 years, repairs and replacements were made which added $5,000 to the value of the machines and it was estimated increased their life 3 years. No change being estimated in the scrap value.

Solution.

Depreciation per year $\frac{1}{10}$ or 10% for first 3 years,
($40,000 − $2,000) × .10 = $3,800 per year.
$3,800 × 3 = $11,400 depreciation for 3 years.
$38,000 − $11,400 = $26,600 book value at end of third year.
$26,600 + $5,000 cost of replacements = $31,600.
$31,600 × .10 = $3,160 the amount deductable after first 3 years.

Problem 8.

The Beason Gear Company bought a patent on a special hobbing process for $50,000 on Jan. 1, 1928. The patent was issued to the inventor Jan. 1, 1920.

Solution.

Eight years of the life of the patent have elapsed. Since the life of a patent is 17 years, the remaining life is 9 years.

The annual depreciation is therefore $\frac{1}{9}$ or 11.1%.

$50,000 × .111 = $5,560 amount deductable for depreciation.

Obsolescence.

Problem 9.

The Morrow Transmission Company installed 10 Acme Automatics at a cost of $30,000 in 1921; estimated scrap value $3,000. Estimated life 10 years. In 1926, the Mandeville Cold Headers rendered the operation of

[1] For further information see "Prentice-Hall Federal Tax Course," Problems, pp. 33–35.

the Acmes uneconomical so the Morrow Company decided to scrap them by 1927. Find the amount deductable for 1926 and 1927.

Solution.

Rate of depreciation percentage = $\frac{1}{10}$ or 10%.

$30,000 − $3,000 = $27,000 cost less scrap value.

$27,000 × .10 × 5 = $13,500 depreciation for 5 years.

$27,000 − $13,500 = $13,500 to be spread over 1926 and 1927.

$\frac{\$13,500}{2}$ = $6,750 Amount deductable for depreciation for 1926.

$6,750 Amount deductable for depreciation for 1927.

Depletion.

Problem 10.

See Problem 5, page 333. The annual output during 1927 of the mine in the problem was 25,000 tons.

Unit of depletion per ton $1.5775

25,000 × $1.5775 = $39,437.50 depletion charge deductible.

Problem 11.

The Cameron Mining Corporation paid $93,500 for a soft coal mine. The estimate indicated that the deposit contained 400,000 tons of coal. During 1927, 50,000 tons were mined.

$\frac{\$93,500}{400,000}$ = $.2339 unit depletion charge.

50,000 × $.2339 = $11,670 depletion charge deductible.

SUMMARY

In Chap. XVI, the following points were emphasized:

1. Depreciation is a question of physical deterioration.
2. Obsolescence is a question of economic deterioration, due to new conditions such as inventions, which make for more efficient operation.
3. Inadequacy is a question of economic deterioration due to changes in size of products such as a 5-ton crane to handle the products of a company whose units of production have increased from 5 to 10 tons.
4. Depletion is a question of reduction in quantity.
5. Calculations must be made on the original cost and not replacement value.
6. Depreciation, obsolescence, inadequacy, and depletion are cost elements and must be charged off as such.
7. The government recognizes specifically two methods of calculating depreciation—the straight-line method and the production method.
8. Depreciation must be adequately recorded particularly for income-tax purposes.
9. The majority of companies charge the undepreciated value of an old machine directly to Profit and Loss and expect the new machine to pay for itself in 2 years under these conditions.
10. Income-tax laws have done much to clear up questions of depreciation, obsolescence, and depletion and have greatly contributed toward more uniform accounting methods.

CHAPTER XVII

STANDARD COSTS

OBJECT OF CHAPTER: To show the extension of the idea of scientific management to cost system in the form of standard costs. To solve representative problems in standard costs.

General.

In the introduction it was pointed out that progressive accountants studied the work of Frederick W. Taylor and sought to apply to accounting and cost accounting the same principles of predetermination that he (Taylor) has applied to the shop. The result was a gradual development of standard or predetermined costs, which has gathered such a host of followers as to be gradually replacing the order cost system at the present time (1930).

Difficulties of the Order-cost System.

The order-cost system discloses what actually happened in the way of costs—not what should have happened. It further sins by disclosing what actually happened after it is too late to remedy inefficiencies. An order for a part may cost $452.80 to manufacture in January, and the same part may cost $512.30 in June. There may be many reasons for this increased cost but modern management wants to know why this increase, and in time to remedy (if possible) the factors that cause it. The increased cost may be due to increased cost of materials, or the purchasing of inferior materials by the purchasing department, thus causing greater waste. Hiring operators at higher rates of pay, using a more expensive machine in manufacture, and making additional setups due to breakdowns are some of the factors that may contribute to a higher cost. The management should know of these causes *immediately*, not at the completion of the order, and should do all in its power to remedy them.

For example, W. S. Kemp, Treasurer of the Holtzer-Cabot Electric Company, in describing certain features of that company's cost accounting system, says,

The brief description of the various parts, operations, values, etc., shown on the cost record, together with the fact that certain parts are common to other sizes will make it clear to all that such a product (an electric bell) must be made on the stock parts order system, that is to say, the manufacturing order would not call for the manufacture of so many bells of this type and size, but instead each part would be manufactured on a separate production order in whatever quantities it could be made most efficiently and economically, all factors being considered, such as capital invested, obsolescence, etc. As these parts are manufactured, they are placed in finished parts stores and requisitioned on an assembly order as completed bells are needed.

Production orders for the manufacture of parts under such a system are usually issued on the basis of a high and low limit. Some inexpensive parts which are made on an automatic screw machine, for instance, might be made in quantities that would cover the normal demand for a year, while some other more expensive part, the manufacture of which required no time for "setting-up," might be manufactured only as required for an assembly order. This means that when assembling one of these bells, parts are used, some of which may have been completed 1 month, some 2 months, some 3 months, and so on up to a year or more ago and the raw materials for which may have been bought long before that.

Under such conditions, what should be considered the cost of the product on the date the completed article was assembled? If we decide that it should be actual cost, of what value would such a cost be at that time for determining current or future costs on the same article?[1]

It seems that the establishment of the true manufacturing cost of a given article is comparable to fixing the premium for a life insurance policy. No actuary would think of basing the premium on the amount of death claims for any short period of time. He cannot tell which or how many men out of a group of 1,000 will die next month or the month after, but he can tell with amazing accuracy the average length of time the 1,000 men will live. In other words, he has an "experience table" covering a period of time which gives him the "Normal" and on that basis insurance companies are able to safely contract future obligations running into the millions.[2]

Establishing Standards.

In installing a standard cost system, a survey must be made of the industry under consideration. First, its purchasing policies must be investigated and an attempt made to keep the

[1] From National Association of Cost Accountants' Year Book, p. 175, 1923.

[2] From Kemp, W. S., "Departmental and Standard Costs," p. 24.

cost and quality of the materials as nearly uniform as possible. Then its labor policy must be firmly and uniformly established in the form of definite rates of pay for a particular grade of work, together with careful time studies of the shop operations. Expense distribution must be adequately handled by one of the approved methods of distribution outlined in Chap. XIV. True, this involves a lot of work, but any firm that has not accomplished these widely accepted fundamentals of management will find it difficult to hold its own, or advance further.

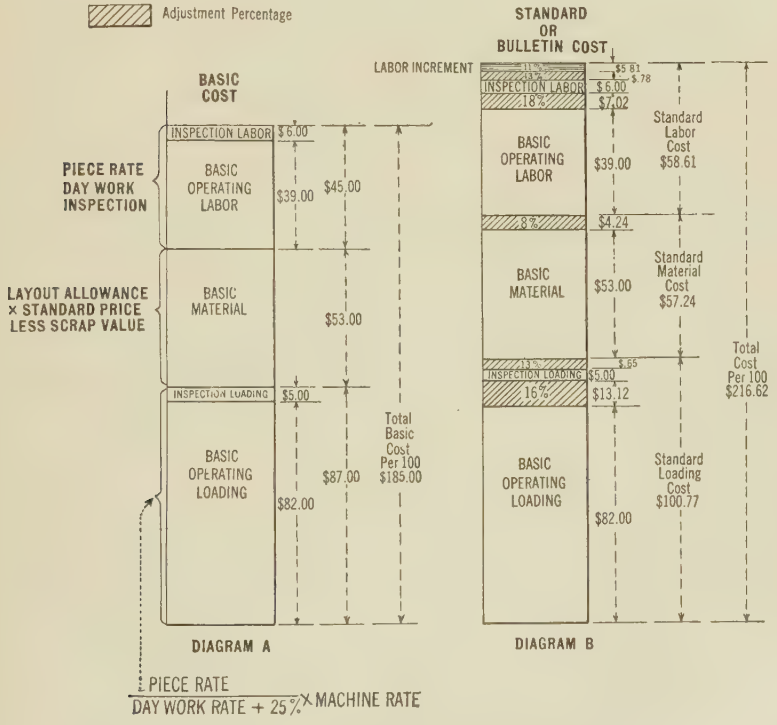


Fig. 61.—Diagrams to illustrate compilation of a standard cost.

Figure 61, Diagram *A*, taken from a prominent electrical industry will illustrate how standard costs are compiled. First, the basic or ideal cost is compiled.

1. Basic material cost is obtained by multiplying the layout allowance as obtained from the drawings and bills of material by the standard unit price of the material.

2. Basic operating labor is determined from the piece rates of the job plus any day work required plus the labor of inspection.

3. Basic operating loading (expense) is obtained by multiplying the time spent on the job by the machine rate. This is computed as follows:

$$\frac{\text{Piece rate}}{\text{Day work rate} + 25\%} \times \text{machine rate.}$$

This company sets its rates so that the average operator should make 25% above his day work rate when working piece work.

Consequently,

$$\frac{\text{Piece rate}}{\text{Day work rate} + 25\%} \text{ gives the time on the job.}$$

Many companies stop here saying this is the basic or standard cost. There is always a danger, however, in setting the standards too "tight." It is extremely discouraging for executives to aim at standards they feel are impossible. In some cases they will be taken as a joke. As a result, many companies "adjust" these ideal or basic costs by certain percentages derived from long experience which bring the ideal costs nearer a practical figure.

Standard or Bulletin Cost.

Figure 61, Diagram *B*, shows the compilation of a standard cost by adjusting the basic cost of Diagram *A*.

1. Standard material cost = Basic material cost + Basic material cost × Adjustment percentage = \$53 + (.08 × 53) = \$57.24.

In a similar manner, applying percentages to the other factors the following is obtained.

2. Standard operating labor:

	\$39.00	Basic operating labor
\$39 × .18 =	7.02	Labor adjustment
\$ 6 × .13 =	.78	Inspection adjustment
	6.00	Inspection labor
	\$52.80	Standard labor cost.

To the figure, $52.80, must be added a "labor increment percentage" to cover such items as overtime allowances, vacation payments, benefit funds, etc.

	$52.80	Standard labor cost
$52.80 × .11 =	5.81	Labor increment allowance
	$58.61	Total standard labor cost.

3. Standard loading cost,

	$ 82.00	Basic operating loading
$82 × .16 =	13.12	Loading adjustment
	5.00	Inspection loading
$ 5 × .13 =	.65	Inspection loading adjustment
	$100.77	Total standard loading cost.

The Standard or Bulletin Cost is then,

Standard Material Cost	$ 57.24
Standard Labor Cost	58.61
Standard Loading Cost	100.77
	$216.62

This completes the illustration of building up a standard cost. The expression, "bulletin cost," is used by some companies, but its use is by no means general. This particular illustration was drawn from a large industry where standard costs were revised annually and the process was referred to as getting out the "bulletin."

Use of Standard Costs.

Figure 62 illustrates a monthly report for comparing actual costs with standard cost. It shows the executive how closely he is coming to his "bogey" (standard). For example, No. 1 Switchboards Bulletin Value (standard cost) is $24,228, while the actual cost is $25,188. This shows the actual cost has exceeded the bulletin or standard cost by 4.1%, or the ratio of the actual cost to the standard cost is 104.1%. It further shows that, for the cumulative 6 months, the actual cost has exceeded the standard by 3.5%, and, if costs continue at the present rate, an estimate for the ensuing months will be such that at the end of the year the standard cost will have been exceeded by 2.5%. In this way, a real check is had on the operation of the company.

COMPARISON OF ACTUAL COSTS WITH BULLETIN (STANDARD) FOR THE CURRENT MONTH, CUMULATIVE PERIOD AND ESTIMATED COSTS FOR THE YEAR

Description of Apparatus	Current month, June			Cumulative 6 months			Estimate for year		
	Bulletin Value	Actual Value	Per cent of Bulletin	Bulletin Value	Actual Value	Per cent of Bulletin	Bulletin Value	Actual Value	Per cent of Bulletin
Telephone Apparatus									
Apparatus Items									
Factory cabling	No figures available			$ 124,933	$ 142,923	114.4	$ 222,909	$ 244,818	109.8
B.B.E. wire	No figures available			73,867	81,559	110.4	315,094	345,703	109.7
Flameproof wire	No figures available			940,074	908,111	96.6	1,853,583	1,794,215	96.8
Relays	No figures available			492,260	454,356	92.3	1,028,977	942,768	91.6
Repeating coils	No figures available			555,856	534,178	96.1	1,037,303	968,443	93.3
Retardation coils	No figures available			294,181	270,647	92.0	555,480	522,801	94.1
Switchboard cable	No figures available			461,512	454,128	98.4	926,704	910,947	98.3
Switchboard Items									
No. 1 switchboards	$ 24,228	$ 25,188	104.1	$ 142,906	$ 149,181	103.5	$ 283,964	$ 291,062	102.5
Small multiple	69,316	70,411	101.9	317,954	320,197	100.5	691,119	694,316	100.2
No. 550 switchboards	37,686	37,449	99.4	187,140	185,047	99.0	437,922	435,654	99.6
No. 505 switchboards	18,562	18,445	99.4	92,174	90,445	98.0	184,891	183,076	98.9
Desks	10,492	10,566	100.7	38,951	39,427	101.1	132,824	133,396	100.2
Manual wired units	15,888	16,250	102.3	89,586	92,007	102.8	206,280	209,117	101.5
Fuse panels	1,913	2,077	108.0	6,677	7,377	110.5	29,037	29,862	103.0
Power boards	2,753	2,988	108.6	9,609	10,488	109.2	294,286	297,409	101.0
Distributing frames and relay racks	16,413	17,182	104.9	79,013	82,877	104.9	148,979	153,329	102.8
Cable racks P.P.	3,385	3,314	97.9	24,291	23,654	97.5	52,397	51,704	97.7
Wired keyshelves	5,139	5,335	103.8	19,000	19,698	103.5	41,562	42,367	102.0
Total T. A.	.....	.....	.....	$3,949,984	$3,866,300	98.0	$ 8,443,311	$ 8,250,987	97.8
Lead-covered Cable									
Lead-Covered Cable	$1,020,272	$977,931	95.85	$5,614,887	$5,463,285	97.3	$10,712,739	$10,391,357	97.0
Grand Total	.....	.....	.....	$9,564,871	$9,329,585	97.8	$19,156,050	$18,642,344	97.4

FIG. 62.

Application of the Standard Cost System.

The following illustrated example will show how standard costs work in an average-sized manufacturing industry. The definitions and examples parallel closely the operations of actual practice.

Standard, or specification, cost is the standard allowable price to be paid for material and for labor and requires the use of standard expense. The sum of standard material, standard labor, and standard expense, with an allowance for scrap and contingency percentage (adjustment percentage), constitutes standard factory cost.

A controlling ledger account is maintained at all times showing the value of the partly processed goods. As in the previous illustrations, it may be likened to a reservoir in which the cost of material, labor, and standard burden accumulates as the work progresses, and out of which the value of the finished goods flows on completion of the work. Each shop and department has a Work in Process Account just as it has an account for other things.

Material.

The cost of material includes the price as delivered by the vendor, freight charges to get it to the factory, and storage and handling charges at the factory.

As was illustrated in the diagrams on preceding pages, in Chap. XIII (Figs. 31 and 34), it is the function of the planning department to buy the material through the purchasing agent and the function of the stores department to receive and store for issue to the shops as required.

A typical manufacturing department may be taken for illustration to show how costs are collected. Let it be assumed that it is necessary to draw 2,000 pounds of steel, worth \$.042 per pound according to the stores' books price, which includes incoming freight and the *latest purchase price.* There is a standard handling charge of 12% added to pay for the cost of operating the stores department. The total cost, $\$.042 \times 2{,}000 \times 1.12 = \$94$, is then entered on the material issue.

The material issue passes on to the cost clerk who checks the price with the standard cost which shows the material priced at \$.050 per pound or $\$.050 \times 2{,}000 \times 1.12 = \$112$ for the amount of steel issued.

Under the standard cost system, this means that a normal or standard price has been established at $.050 per pound to avoid fluctuation in standard costs due to rise and fall in current market prices, and the present market price being lower than normal has resulted in a price below the standard cost. This normal price is analogous to the standard burden rate previously mentioned and the variance in price will be handled by charging the standard price into the Work in Process account and crediting the difference into a variance account called "Excess Material Account."

The accountant would make the following entries in his books:

Steel Stores	
	2,000 units, $94

Work in Process	
Steel Material, $112	

Material Variance Account	
	Excess Material, $18

Actually, the accountant would not make a single entry in the control accounts but would collect all the tickets over a monthly period, total them, and then make a single entry for the whole month's operation.

Labor.

The principal method of payment in this plant, let it be assumed, is straight piece work, although day work exists in some places when it is not practical to use piece work. Piece-work rates are, of course, determined by time studies and scientific methods. The standard labor cost is based on these piece rates. Where day work is used, the equivalent piece rate is calculated.

When an operator finishes his work, he receives credit on his time ticket for the number of pieces turned in, and turns in his ticket to the time clerk.

The ticket is then forwarded to the payroll department where the piece rate is checked and extended on the ticket.

It sometimes happens that an operator may be on day work, and his earnings are in excess of those on the standard cost sheets. This difference is called "excess labor" and is charged into a variance account set up for this purpose.

If an operator is on piece work and is unable to make his day's pay, due to faulty material or tools, he is paid his basic day wage, and the difference is charged in the Excess Labor Account.

An example of the accounting would be as follows:

Direct Labor Payroll		
H. White..	$5.20	$5.20
J. Black...	4.80	4.80
H. West...	6.30	6.30

Work in Process	
$5.20	
3.90	
4.50	

Labor Variance Account	
$ .90	
1.80	

White, it will be noted, made his piece-work rates according to standard and work in process as charged, $5.20. Black and West each fell below standard, and the difference between their payment and standard pay was charged to the Labor Variance account.

Factory Expense.

Expense is charged into Work in Process merely by extending the predetermined rate by the number of hours (see Chap. XIV).

Summary of Costs at the End of the Month.

It is now possible to obtain an overall picture. Material, labor, and expense charges have accumulated during the month and are ready to be disposed of in order that the financial condition may be determined and proper control exercised. It is desired to know how close to standard cost the plant has been operating as a measure of its efficiency.

Let it be assumed that the addition of other material has swelled the material to $520 plus excess of $150, and the labor has amounted to $1,500 plus an excess of $180. Factory expense is distributed according to the machine-rate method and amounts to $1,800, $220 of which is underabsorbed.

The excess cost of material, labor, and burden are entered in the Cost Variance Account. Since a certain amount of contingency, including scrap, based on standard material, labor, and expense is allowed, the Cost Variance Account is credited with a certain figure. In this case, 15% was allowed on labor, material, and expense, and Work in Process is therefore debited, ($520 + $1,500 + $1,800) × .15 = $573.

During the month, Work in Process completed, priced at standard cost and charged into the Finished Goods Account amounted to $2,500.

Balance, Jan. 1, Work in Process was $12,000 and in Cost Variance was $300.

The accounting procedure to record these transactions is shown in the following diagrammatic illustration. Each account

Work in Process			Finished Goods
Jan. 1, Balance	$12,000	Jan. 31, $2,500 completed	$2,500
Jan. 31, Labor	1,500		
Material	520		
Expense	1,800		
Contingency (15%)	$573		

Cost Variance		
Jan. 1, Balance	$300	Jan. 31, Contingency $573
Jan. 31, Excess labor	180	
Excess material	150	
Underabsorbed Burden	220	

is balanced in the usual accounting manner. The balance in the Cost Variance Account is held over from month to month where it should show a tendency to disappear with the turnover of work. A gradual *increase* would show certain inefficiencies in operation and might require an increase in contingency rates and conversely a too rapid decrease might tend to reduce contingency rates.

The same procedure takes place for all other Work-in-Process Accounts for different classes of articles. All these accounts flow into one master control account for this particular department, which compiled with other departments makes up the entire plant inventory of work in process. It is now necessary to distribute this information to the various executives, superintendents, and others for their guidance and supervision. This is usually accomplished by means of statements and reports of various natures.

Advantages of Standard Costs.

Standard costs permit the following:

1. The establishment of a foundation for setting sales prices.
2. The incentive to manufacture for the prices set.
3. A gage of efficiency in manufacturing.
4. A gage of selling efficiency.

5. A common method of measurement so that all cost information may be compared.

6. Budgeting of the expense of the various departments and divisions.

7. Savings in clerical work, and the obtaining of more accurate information.

A good illustration of point 7 is in collecting direct labor costs. Under the order-cost system an operator may punch in and out on as many as 15 or 20 small jobs in the course of a day. Such a procedure takes time and clerical effort and enables an operator to partly manipulate the allocation of his time. Under a standard-cost plan, all labor is charged in at a standard figure and punching in and out on each job is unnecessary. At the end of the day, the operator's production at the standard labor figure is taken and compared with the total time as shown by his clock card. The resulting figure is the measure of the worker's efficiency.

THREE TYPICAL PLANS OF STANDARD COSTS OUTLINED BY THE DEPARTMENT OF MANUFACTURING OF THE UNITED STATES[1]

A comprehensive study of standard costs and their practical application to industry has been made by the Department of Manufacture of the United States and presented, to those interested, in a pamphlet entitled "Cost Accounting through the Use of Standards." In this study, which is reproduced in part in the following pages, each element of cost, *i.e.*, direct material, direct labor, and expense (overhead) is considered separately and three typical accounting plans presented. The reader should follow through the analysis of each element of cost according to the three plans outlined. At the conclusion of this study it would be highly desirable to study each plan as a separate entity.

The Diversity of Plans for the Control of Standard Costs

One of the characteristics of cost accounting through the use of standards, as practiced at the present time, is the diversity of plans for the control of the standard costs through the accounts in the General Ledger or Factory Ledger. As experience with this method is gained, undoubtedly the accounting treatment will itself become standardized. In the meantime, however, the only practicable course appears to be

[1] From "Cost Accounting through the Use of Standards," Department of Manufacture. Chamber of Commerce of the United States, Washington, D. C. E. W. McCullough, Dept. Manager, Thomas W. Howard, In Charge of Cost Accounting.

to present representative plans, *i.e.*, those plans in satisfactory use in various lines of industry.

Accordingly, in the case of the accounting treatment of material three such plans will be presented. It seems advisable, in addition, to discuss each of these three plans in some detail.

Accounting for Material.

Typical Plan 1.—The plan which possibly is in widest use is that where all of the accounts are carried at actual cost values for the material element of cost. Obviously, if this result is to be accomplished, it will be necessary to operate a job cost system in addition to the standard cost system, or to obtain the values used in the accounts through some mathematical computation. The problem, fundamentally, consists in crediting Work in Process with amounts which will exactly offset the values charged to that account. Suppose, for example, a given lot of material is put into process at 50 cents per pound, another lot at 45 cents per pound, and a third lot at 60 cents per pound. Under the job cost plan, these lots are charged against specific orders, and, when those orders are completed, Work in Process may be credited with the exact amounts charged.

Under the Standard Cost Plan, however, job costs are not obtained and another method must be employed. Attention is now directed to Fig. 63, which presents an illustration of how the desired result is accomplished.

It will be observed that in the case of Work in Process Material, there are two sets of columns for both the debit and credit sides—one set headed Actual and the other Standard. The columns headed Actual are the ones employed in the accounting. The columns headed Standard are for the introduction of statistical figures, and these figures do not appear in the accounting.

As materials are purchased they are charged to Raw Material at actual cost. All deliveries of raw material from the storeroom to the factory are covered by requisitions and in the cost department these requisitions are priced through the use of the actual unit costs, as revealed by the perpetual inventory cards, and also at the standard unit values. Furthermore, if the quantities for the particular requirements, if these are known, the requisitions, show two quantities and there are two extended values; *i.e.*, (1) actual quantities times actual unit costs, and (2) standard quantities times standard unit costs.

Raw Material is credited with the total of the actual values thus obtained and, in the diagram, the deliveries of material to the factory for the month of January have a total value at cost of $1,600. The standard value is $1,200.

Referring now to Work in Process Material, it will be observed that, on Jan. 1, the inventory of material in process revealed an actual value

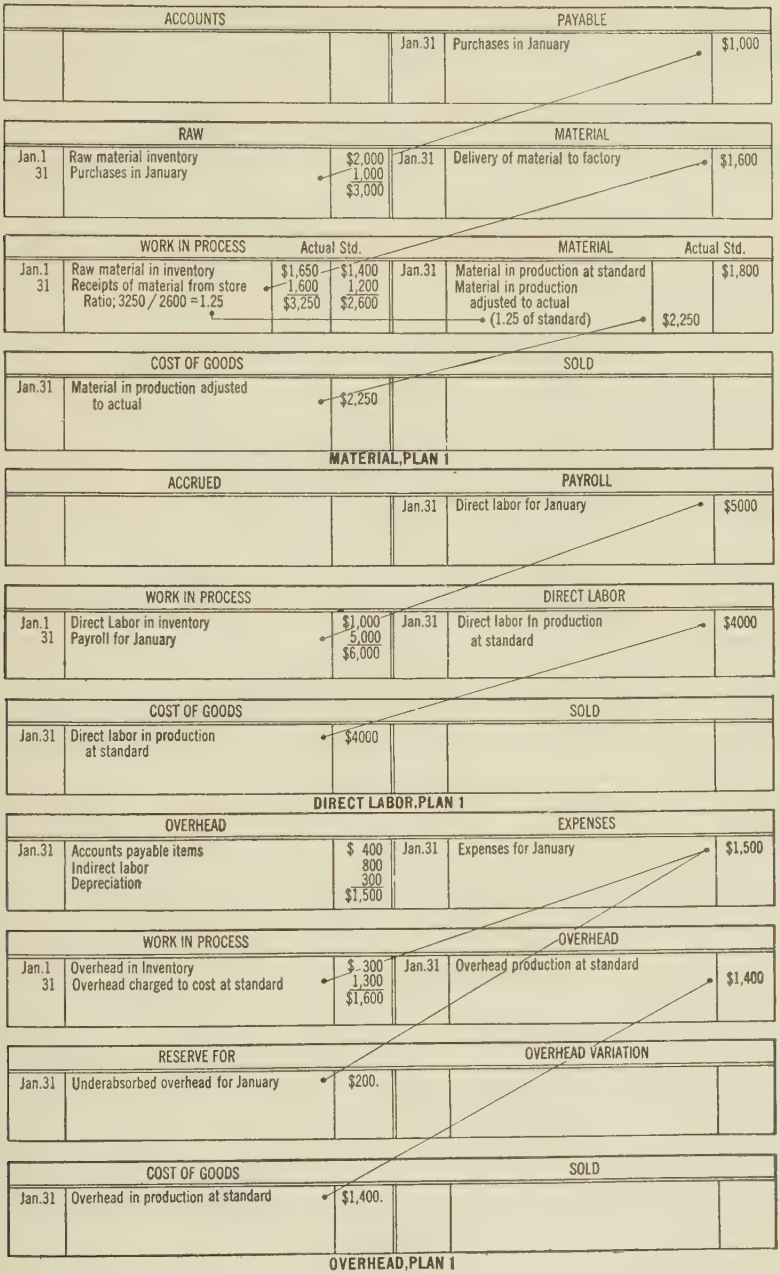

ACCOUNTS PAYABLE
Jan.31 Purchases in January $1,000
RAW MATERIAL
Jan.1 Raw material inventory $2,000
31 Purchases in January 1,000
$3,000
Jan.31 Delivery of material to factory $1,600
WORK IN PROCESS Actual Std.
Jan.1 Raw material in inventory $1,650 $1,400
31 Receipts of material from store 1,600 1,200
Ratio; 3250 / 2600 = 1.25 $3,250 $2,600
MATERIAL Actual Std.
Jan.31 Material in production at standard $1,800
Material in production adjusted to actual (1.25 of standard) $2,250
COST OF GOODS SOLD
Jan.31 Material in production adjusted to actual $2,250
MATERIAL, PLAN 1
ACCRUED PAYROLL
Jan.31 Direct labor for January $5000
WORK IN PROCESS DIRECT LABOR
Jan.1 Direct Labor in inventory $1,000
31 Payroll for January 5,000
$6,000
Jan.31 Direct labor in production at standard $4000
COST OF GOODS SOLD
Jan.31 Direct labor in production at standard $4000
DIRECT LABOR, PLAN 1
OVERHEAD EXPENSES
Jan.31 Accounts payable items $ 400
Indirect labor 800
Depreciation 300
$1,500
Jan.31 Expenses for January $1,500
WORK IN PROCESS OVERHEAD
Jan.1 Overhead in Inventory $ 300
31 Overhead charged to cost at standard 1,300
$1,600
Jan.31 Overhead production at standard $1,400
RESERVE FOR OVERHEAD VARIATION
Jan.31 Underabsorbed overhead for January $200.
COST OF GOODS SOLD
Jan.31 Overhead in production at standard $1,400.
OVERHEAD, PLAN 1

FIG. 63.

of $1,650 and a standard value of $1,400. The inventory values and the values of deliveries from store are totaled and the ratio of actual values to standard values obtained; *i.e.*, the ratio in this case is 1.25.

During the month of January, the factory has produced and shipped to customers a certain number of the company's products, which, priced with respect to material, have a standard value of $1,800. To obtain the corresponding actual value of this delivery, it is necessary only to multiply the standard value, $1,800, by the ratio, 1.25, which gives an adjusted actual value of the production of the month of $2,250. This, then, is the amount which is credited to Work in Process Material, and charged to Cost of Goods Sold.

This plan, while simple in principle, may present some complications in practical operation. For one thing, in some lines of business, it may not be possible to determine the standard quantities which should have been delivered from stock. For example, in a knitting mill, the deliveries of yarn to the factory, while subject to requisition, may be for the quantities required to keep the machines in operation, rather than the exact quantities figured to be required by a certain number of the garments manufactured. Of course, in other cases, it will not be difficult; for example, if the work of the factory were that of machining crankshafts, the actual number of forgings withdrawn from stock would agree with the standard quantities.

Where it is difficult to distinguish between actual and standard quantities, it may prove reasonably accurate for the purpose of accounting control to assume that the actual quantities delivered are also the standard quantities. In such a case, however, it will be very desirable to make constant checks in the factory of the efficiency of use of the material.

This plan of material control may also be criticised for use in some places because of the clerical labor involved in pricing all requisitions at two values. Whether or not this extra clerical labor is so great as to preclude its use must be determined in each individual case.

Typical Plan 2.—A second plan for control of materials involves the use of a special account which may be entitled Profit and Loss on Materials Used. This plan is outlined in Fig. 64. The procedure is similar to that in Typical Plan 1, with the exception that the variation between actual values and standard values of materials delivered from the storeroom to the factory is carried to the account, Profit and Loss on Materials Used. In the illustration, the deliveries of material at the actual unit cost aggregate $1,600 for the month of January. Work in Process Material, however, is charged with $1,200 and the difference, $400, appears as a charge to Profit and Loss on Materials Used. As pointed out in the discussion of Typical Plan 1, this variation of $400 may arise from two causes—variations in unit prices, and variations in quantities

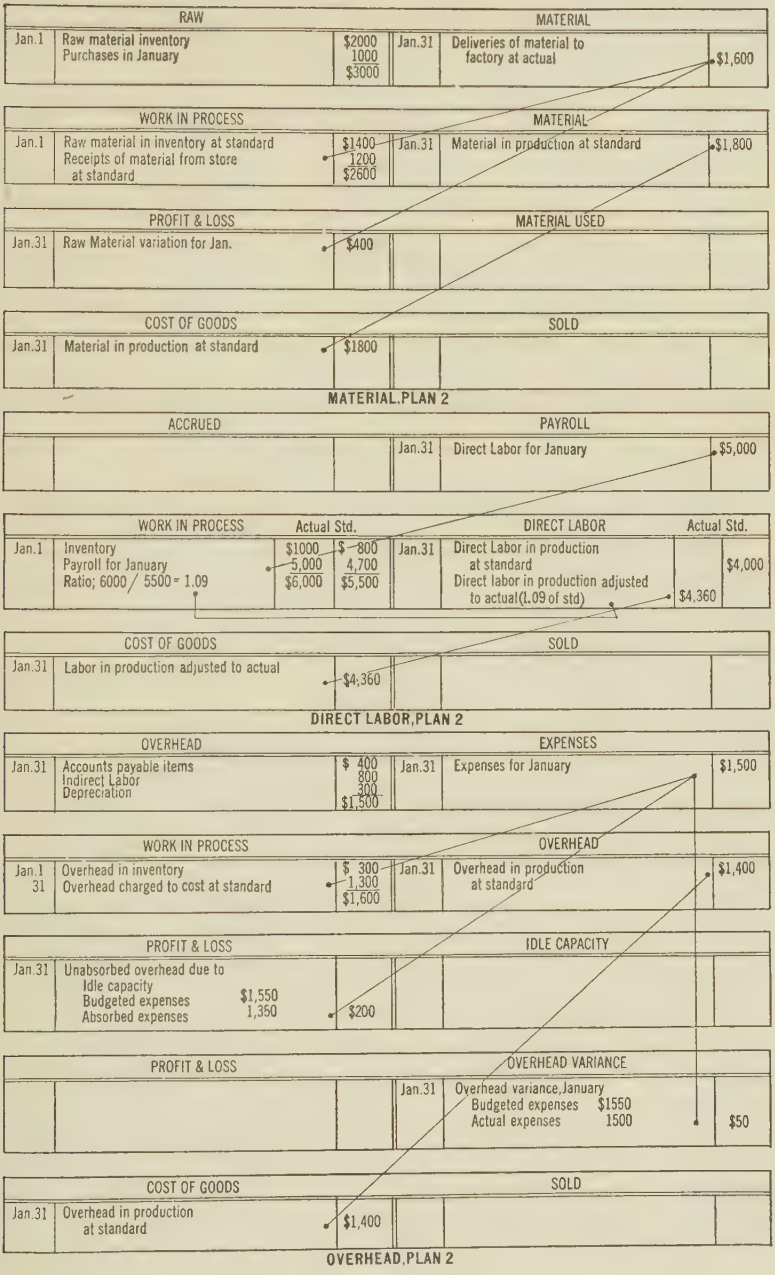

RAW MATERIAL
Jan.1 Raw material inventory $2000
Purchases in January 1000
$3000
Jan.31 Deliveries of material to factory at actual $1,600
WORK IN PROCESS MATERIAL
Jan.1 Raw material in inventory at standard $1400
Receipts of material from store at standard 1200
$2600
Jan.31 Material in production at standard $1,800
PROFIT & LOSS MATERIAL USED
Jan.31 Raw Material variation for Jan. $400
COST OF GOODS SOLD
Jan.31 Material in production at standard $1800
MATERIAL.PLAN 2
ACCRUED PAYROLL
Jan.31 Direct Labor for January $5,000
WORK IN PROCESS Actual Std. DIRECT LABOR Actual Std.
Jan.1 Inventory $1000 $ 800
Payroll for January 5,000 4,700
Ratio; 6000 / 5500 = 1.09 $6,000 $5,500
Jan.31 Direct Labor in production at standard $4,000
Direct labor in production adjusted to actual(1.09 of std) $4,360
COST OF GOODS SOLD
Jan.31 Labor in production adjusted to actual $4,360
DIRECT LABOR,PLAN 2
OVERHEAD EXPENSES
Jan.31 Accounts payable items $ 400
Indirect Labor 800
Depreciation 300
$1,500
Jan.31 Expenses for January $1,500
WORK IN PROCESS OVERHEAD
Jan.1 Overhead in inventory $ 300
31 Overhead charged to cost at standard 1,300
$1,600
Jan.31 Overhead in production at standard $1,400
PROFIT & LOSS IDLE CAPACITY
Jan.31 Unabsorbed overhead due to
Idle capacity
Budgeted expenses $1,550
Absorbed expenses 1,350
$200
PROFIT & LOSS OVERHEAD VARIANCE
Jan.31 Overhead variance,January
Budgeted expenses $1550
Actual expenses 1500
$50
COST OF GOODS SOLD
Jan.31 Overhead in production at standard $1,400
OVERHEAD,PLAN 2

FIG. 64.

of material used. For example, if the actual cost of the material, as shown by the perpetual inventory card, is 50 cents per pound, and the standard unit value is 40 cents per pound, there is a variation of 10 cents per pound on each pound withdrawn from the storeroom. On the other hand, if 110 pounds of material are withdrawn from the storeroom, where the standards indicate that 100 pounds are sufficient, there is here an excess withdrawal of 10 pounds. In some instances, it may be feasible to separate the variations due to prices from those due to quantities.

Typical Plan 3.—The third plan for the control of material under standard costs contemplates that the variations due to unit prices be set aside at the time the material is purchased. Reference is made to Fig. 65, which as will be seen, employs an account entitled Profit and Loss on Material Purchases. For example, during the month of January, raw material was purchased at an actual cost of $1,000. Let it be assumed that this represents the purchase of 800 pounds of material at an actual cost of $1.25 per pound; also, that the standard value at which the material is to be carried into the accounts is at the rate of $1 per pound, or a standard value of $800. The variation is carried as a charge to Profit and Loss on Material Purchases.

As raw material is withdrawn from storeroom, it may be the practice to show on the requisitions the quantities that should have been withdrawn if production met the standards, as well as the actual withdrawals, if more material or less material is taken out than would seem to be required. If this be done, the procedure will follow that discussed in Typical Plan 2 and another account—Profit and Loss on Materials Used, established. As pointed out, however, there may be practical difficulties in carrying out this part of the plan. Consequently, the actual deliveries of raw material at the standard values are credited to Raw Material and charged to Work in Process Material, on the basis of the actual deliveries of raw material at the standard unit values.

As work on the goods is completed and the products shipped to customers, Work in Process Material is credited with the product of the standard quantities of material in the product and the standard unit values. Consequently, Work in Process Material may be unbalanced, and the residue in the account on the debit or credit side will represent the variation between the use of standard quantities and of the quantities actually employed in production. Unfortunately, under such a condition, this residue will remain in the account, through being hidden in the inventory values, until the end of the year at which time a physical inventory will reveal its existence and its amount. Consequently, where there is likely to be considerable variation between actual and standard quantities, this plan may be not entirely satisfactory.

It may appear from the description of these three plans that the accounting for material in a standard cost system is complicated and

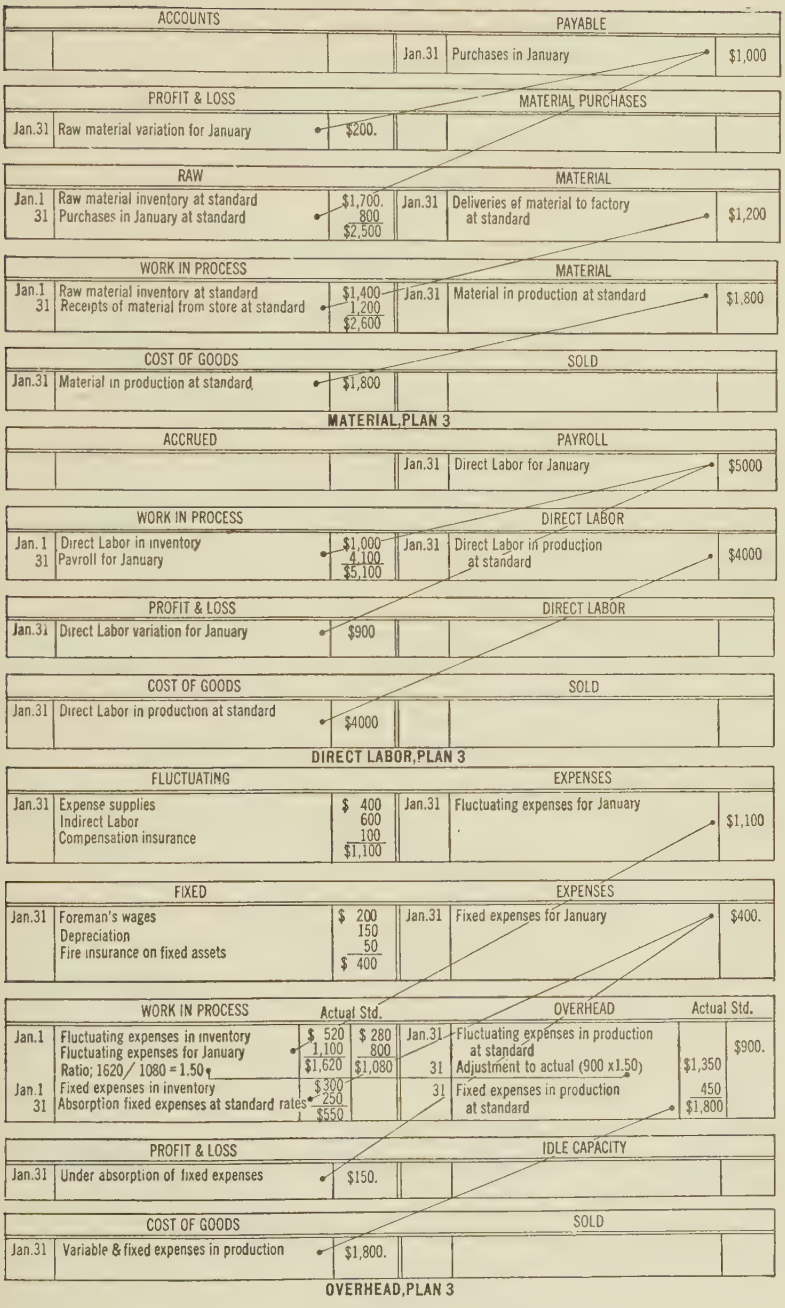

ACCOUNTS PAYABLE
Jan.31 Purchases in January $1,000
PROFIT & LOSS MATERIAL PURCHASES
Jan.31 Raw material variation for January $200.
RAW MATERIAL
Jan.1 Raw material inventory at standard $1,700.
31 Purchases in January at standard 800
$2,500
Jan.31 Deliveries of material to factory at standard $1,200
WORK IN PROCESS MATERIAL
Jan.1 Raw material inventory at standard $1,400
31 Receipts of material from store at standard 1,200
$2,600
Jan.31 Material in production at standard $1,800
COST OF GOODS SOLD
Jan.31 Material in production at standard $1,800
MATERIAL, PLAN 3
ACCRUED PAYROLL
Jan.31 Direct Labor for January $5000
WORK IN PROCESS DIRECT LABOR
Jan. 1 Direct Labor in inventory $1,000
31 Payroll for January 4,100
$5,100
Jan.31 Direct Labor in production at standard $4000
PROFIT & LOSS DIRECT LABOR
Jan.31 Direct Labor variation for January $900
COST OF GOODS SOLD
Jan.31 Direct Labor in production at standard $4000
DIRECT LABOR, PLAN 3
FLUCTUATING EXPENSES
Jan.31 Expense supplies $ 400
Indirect Labor 600
Compensation insurance 100
$1,100
Jan.31 Fluctuating expenses for January $1,100
FIXED EXPENSES
Jan.31 Foreman's wages $ 200
Depreciation 150
Fire insurance on fixed assets 50
$ 400
Jan.31 Fixed expenses for January $400.
WORK IN PROCESS Actual Std.
Jan.1 Fluctuating expenses in inventory $ 520 $ 280
Fluctuating expenses for January 1,100 800
$1,620 $1,080
Ratio; 1620 / 1080 = 1.50
Jan.1 Fixed expenses in inventory $300
31 Absorption fixed expenses at standard rates 250
$550
OVERHEAD Actual Std.
Jan.31 Fluctuating expenses in production at standard $900.
31 Adjustment to actual (900 x 1.50) $1,350
31 Fixed expenses in production at standard 450
$1,800
PROFIT & LOSS IDLE CAPACITY
Jan.31 Under absorption of fixed expenses $150.
COST OF GOODS SOLD
Jan.31 Variable & fixed expenses in production $1,800.
OVERHEAD, PLAN 3

FIG. 65.

troublesome. This is by no means necessarily so, nor have the accounting possibilities been exhausted by the description of these three plans. While it is always desirable to develop a plan which is mathematically sound and correct in accounting technique, still it may be necessary to employ a modification which introduces certain theoretically unsound features. Where this practice is adopted, it is important to appraise in advance the degree of inaccuracy that is to be expected.

Accounting for Labor.

As in the case of material, three typical plans for controlling standard costs in the case of direct labor are presented in Figs. 63, 64 and 65. An examination of these plans will reveal that, in the first case, the accounting in theory is decidedly faulty, in that Work in Process Direct Labor is charged with actual labor costs and credited with the standard labor costs in production or shipments. Accordingly, there remains in Work in Process Direct Labor, the residue, debit or credit as the case may be, due to this faulty accounting, which will not be revealed until the end of the year and an actual inventory of the goods in process of manufacture is taken. This plan, however, is in use by a number of very large companies. One such company is in the agricultural implement industry where practically all employees contributing to the direct labor cost are paid on the basis of piece rates. Here there can be no variation between actual and standard costs, except in those cases where work is done on hourly rates or on some other time basis not associated with actual production. This company has found, so it is stated, that the accounting error is small and from a practical point of view is negligible.

In the case of Typical Plan 2, the labor costs are carried through Work in Process Direct Labor, by an adjustment of the standard costs to actual costs in the same way as has been described in the case of Typical Plan 1 for raw material.

Typical Plan 3 for direct labor involves the use of a special Profit and Loss account, into which is diverted the variation between standard costs and actual labor costs at the time Work in Process Direct Labor is charged. Let it be supposed, for example, that production standards have been established in a factory where the method of wage payment is still that of an hourly rate. For example, an employee in the grinding department may be paid 60 cents per hour and the production standard, for the purpose of supervision of output and cost accounting, of 60 parts per hour has been set. If his actual production falls below this figure, the direct labor cost is 1 cent per part, while if his production drops to 40 parts per hour, the direct labor cost is 1½ cents per part.

This is but a single illustration of how a variation in direct-labor cost may be found and treated in the accounting.

Accounting for Overhead.

Accounting for the overhead element of cost presents few peculiarities that are not found in accounting under any method of cost determination. On the other hand, accounting for overhead presents many difficulties in any cost system and the matter is handled in a wide variety of ways.

Under Typical Plan 1 (Fig. 63), Work in Process Overhead is charged with the value of overhead absorbed through the use of standard overhead rates and the standard value of the production expressed in terms of direct-labor wages, labor-hours, or machine-hours, as the case may be. Let it be supposed, for example, that a rate of $2 per employee-hour has been set as the standard rate for Operating Center A. During the month, 650 hours have been spent by direct-labor employees in the operation of the center. Accordingly, the absorption of overhead expenses by the production center has been $1,300.

The actual expenses of the center, however, for the month in question, are found to be $1,500 and, obviously, there has been an underabsorption for that particular month of $200. Under the plan shown, this underabsorption appears as a charge to Reserve for Overhead Variation.

As goods are finished and shipped to customers (it being assumed here as elsewhere that goods are not put in stock and that there is no account, Finished Goods), Work in Process Overhead is relieved; that is, credited with the standard value of overhead in the products manufactured and shipped, and a corresponding charge is made to Cost of Goods Sold. Under this plan, therefore, Work in Process Overhead is charged and credited with like values; that is, whatever has gone into the account has been taken out of the account, although, of course, at all times there will be found a balance representing the standard value of overhead in work in process in the factory.

Under Typical Plan 2 (Fig. 64), the same general procedure is followed with the following exceptions: In the first place, some accountants consider the under- or overabsorption of overhead to be in the nature of a direct deduction from, or addition to, profits and, accordingly, the account used is a Profit and Loss Account, which of course appears on the Income Statement rather than on the Balance Sheet, as in the case of a Reserve Account. Furthermore, the under- or overabsorption may be divided into two component parts, namely, the portion which is caused by a variation in expenses other than that due to idleness. For example, assume that the budgeted employee- or machine-hours for a certain production center are 775 while the actual hours are 650. The standard overhead rate is $2 per hour. Then the overhead absorbed, that is, the charge to Work in Process Overhead, amounts to $1,300, while the budgeted expense (budgeted hours times standard rate) is $1,550. The actual expenses of the production center are $1,500.

Under this set of conditions there is a loss on overhead due to the fact that the activity of the center was 125 hours less than its budgeted activity which amounts to $250.

On the other hand, the actual expenses of $1,500 for the month were $50 less than the budgeted expenses of $1,550. Accordingly, there is a saving of $50, or a profit of that amount.

The loss of $250 is set up as a charge to Profit and Loss Idle Capacity, and the saving of $50 appears as a credit to Profit and Loss Overhead Variance.

The entries in Profit and Loss Idle Capacity will always be debit entries owing to the fact that it will be the policy to establish standard overhead rates which are based on a production somewhat in excess of what may be normally expected. On the other hand, the entries in Profit and Loss Overhead Variance may be either on the debit or credit side, depending upon the success or failure of the business in keeping below the budgeted expenses.

The third typical plan (Fig. 65) is somewhat more complex. Under this plan, recognition is taken of the fact that certain expenses of the business, such as depreciation, taxes, and fire insurance on machinery, go on regardless of the rate of production and that a failure to absorb these fixed charges in production should be recorded by a charge to a Profit and Loss Account of the amount not so absorbed.

With regard to fluctuating expenses, however, the plan contemplates that they should be a direct charge to production, whatever their amount, and neither profit nor loss from these expenses should be set apart. It will be seen that actual fluctuating overhead expenses are carried through Work in Process Overhead, by the use of the method described for carrying along the actual cost of materials in Typical Plan 1 for materials.

Fixed charge absorption in Work in Process Overhead, is through the use of standard rates and the variation between the actual fixed overhead expenses and the amount absorbed is transferred to Profit and Loss Idle Capacity, usually as a charge or debit entry.

Modifications of these several plans for the handling of overhead are numerous. In some instances, for example, overhead expenses are budgeted on a sliding-scale basis, whereby for a given rate of factory production, expenses are budgeted or scheduled for that particular rate of production. Under one such plan, overhead expenses are divided into three groups: (1) fixed charges; (2) fluctuating charges which vary in direct proportion to production; and (3) charges which vary in indirect relation to production. Variations are then recorded in somewhat the same fashion as indicated in Plan 2.

Establishment of Accounting Policy.

In concluding the discussion of accounting control, it seems wise to suggest that well-defined policies should be laid down so that accounting

results will have the greatest significance and value to the executive. It would seem unwise, for example, to employ one of the typical plans presented for material, another with different characteristics for labor, and a third for the treatment of overhead. It is impossible in a treatise of this kind to discuss all the fine points of the situation, but it is necessary in the proper design of a standard cost system to carry the reasoning and study of the several methods of accounting to the ultimate conclusion.

By way of specific illustration, one of the typical plans for the treatment of raw-material variations is to set up the variation between actual cost and standard cost at the time the material is purchased. Suppose, for example, that the standard value assigned to a certain material is 50 cents per pound; the first lot purchased, 1,000 pounds, is bought at 80 cents per pound. There is here a variation of 30 cents per pound, or $300. A second lot of 10,000 pounds is bought at 60 cents per pound, or a variation from standard of 10 cents per pound or $1,000. The total variation, therefore, set apart in Profit and Loss on Material Purchases is $1,300.

The goods produced are priced at the standard material value. Let it be assumed that 2,000 pounds of material are used, at a standard price of 50 cents per pound or a standard value of $1,000, which is the value at which the material appears in Cost of Goods Sold.

In setting up the Balance sheet of the company, the Raw Material account which is shown at standard value will record 9,000 pounds of material on hand, with a standard value of $4,500. On the Profit and Loss Statement there will be found, as a deduction from profits, the $1,300 of variation on material purchases. Most of this material, however, is still in stock (*i.e.*, 11,000 − 2,000 = 9,000 pounds) and very obviously profits should not be reduced to the full extent of the variation which, in this illustrative case, is more than the entire standard value of material in goods thus far produced and sold. In fact, in this case, where it is assumed that there is no material left in process of manufacture at the end of the month, the raw-material variation charged to profits should be 2/11 of $1,300 or $236.36 if the weighted average method is used, or $400 if the exhaustion of lots method is followed.

From this illustration, it will be seen that under some conditions the segregation of variations between the actual costs of material purchased and their corresponding standard costs may lead to very erroneous results. It may be assumed that this plan may be most successfully employed where there are but slight variations between actual costs and standard costs. Moreover, it will be recognized that under this plan, or any other plan, inventories of raw materials, work in process, and finished goods in stock, must be repriced at the end of the fiscal year to accord with conventional practices for the pricing of such inventories.

Suggestions on System Design.

The question in the minds of those who have studied the foregoing material on cost accounting through the use of standards probably is, "How can we develop a form of standard cost system that will embody the best practice and give us the information that we understand should be available?" Unfortunately, it is impossible to answer this question through the presentation of detailed plans and specifications. The standard cost system must be *tailor-made* and it is possible only to give certain general suggestions.

The design of the cost-accounting system should be approached from a very practical point of view. Too frequently in the past we have made a fetish of cost-accounting theory and have established cost systems which have been complete and admirable from the point of view of technique, but impracticable and unsatisfactory in operation.

Perpetual Inventory Essential.

There is no easy road by simple methods to close control of costs through the use of standards. As an evidence of this, it is seldom, if ever, satisfactory to dispense with a perpetual inventory system. Control over materials through the use of such a system is important not only from the point of view of cost accounting, but also from the point of view of businesslike conservation of the materials themselves.

The keeping of the perpetual inventory record should be neither unduly expensive nor laborious. Its value will be proved after it has been successfully installed.

Payroll Distribution.

There must be a distribution of payroll that apportions labor costs to accounts that are significant and of direct value in the operation and use of the standard cost system. With an elaborate form of standard cost system, the payroll distribution will be detailed. Accounts for direct and indirect labor for individual production centers will be provided. Under simpler and less exact forms of standard cost system, the distribution by direct and indirect labor will perhaps be to departments and major groups of operations.

Expense Classification.

Similarly, there should be a carefully devised classification of expense accounts for items other than indirect labor. Determination will have to be made as to the number of expense departments and of production centers within the departments.

Normal Costs.

More and more we are focusing attention on normal costs as contrasted with current costs. Seasonal fluctuations in business are constantly with us. Periods of bad business of greater or less extent and

not seasonal in character are met, yet we have come generally to recognize that we cannot charge our customers higher prices when our plant is idle and lower prices when it is busy. We have to base our prices on normal costs for the operation of our plant, changing them only to record market fluctuations in important raw materials and long-run variations in labor costs and overhead expenses.

Normal costs are no less of value to us in watching the efficiency of operation of the plant. We are more concerned with the departure from normal of various features of operation than we are with the actual costs of operation.

From still another point of view, the use of normal costs attracts us. The statement is not infrequently made that "cost is cost," that is, there is but one cost for any article or thing and that the mythical cost is the cost for which we are seeking. Experience with cost-accounting technique, however, is slowly teaching us that no two accountants would arrive at identical cost by presumably the same method. For example, depreciation is but an estimate and some of our pro-rations of overhead expense are arbitrary.

In consequence, our so-called "actual costs" are not at all absolute costs and again we come back to the conclusion that we are more interested in the careful ascertainment of normal costs than we are in the constantly fluctuating figures for actual costs.[1]

Practical Illustrations of Standard Costs.

In line with Taylor's principles of standardizing operations and obtaining standard times for them, great emphasis is being given to such studies today. Such principles, of course, tie in beautifully with any plan of standard costs.

In order to have standard times, careful time studies must be made of the elemental operations involved in the manufacture of an article. Such standard times are then available for the purpose of allocating direct-labor costs, and of being used in operating a wage system, such as straight piece work, or premium plan.

Bedaux Method of Labor Measurement.

One of the most flexible methods of setting standard costs is in connection with Bedaux labor measurement. The Bedaux method of labor measurement is controlled by the International

[1] From "Cost Accounting through the Use of Standard," Department of Manufacture, Chamber of Commerce of the United States, Washington, D. C. E. W. McCULLOUGH, Dept. Manager, THOMAS W. HOWARD, In Charge of Cost Accounting.

Bedaux Company, Inc., of New York, and applied by Bedaux Companies in this and foreign countries. All jobs are carefully time-studied and measured in terms of the same common unit, making it possible to

1. Measure the amount of direct labor by the number of Bedaux units (B's) of direct labor involved.

2. Determine the value of that direct labor by the value per B of the class (or classes) of work involved.

3. Measure the amount of indirect labor in relation to the B's of direct labor representing production.

4. Determine the value of indirect labor by the relative number of B's of each class of indirect work, and the value per B of each class.

As an example, let a certain item, say a cover plate be considered as one of the parts of a product being manufactured. In the first department (department A), there are three operations to be performed on this part; *viz.*,

	B value	Base rate per hour
Operation 1—Stamping	.5	$ .54
Operation 2—Drilling	1.5	.42
Operation 3—Shaping	2.0	.60

The indirect-labor force of the department consists of a foreman, a machine setup man, and a trucker whose combined activities may have a standard cost of $.00125 per B of direct labor. (If they put in more time than is warranted by the volume of production, this surplus becomes an excess cost.)

Hence, it can readily be seen that the standard cost of one cover plate involving the operations of Department A is as follows:

Operation 1.—Since 60 B's of work are expected per hour in return for the basic hourly rate (additional pay is given for work in excess of this 60 B's an hour), the standard cost per B for this operation which pays a base rate of $.54 is $\frac{\$.54}{60} = \$.0091$, the cost of the operation is, therefore, equal to

$$.5 \text{ B's} \times \$.009 = \$.0045.$$

Operation 2.—Standard cost per $B = \frac{\$.42}{60} = .007$

$$1.5 \text{ B's} \times \$.007 = \$.0105.$$

Operation 3.—Standard cost per $B = \frac{\$.60}{60} = \$.01$

$$2 \times \$.01 = \$.020.$$

This may be summarized with the indirect labor included as follows:

Operation A— .5 B's stamping	$.009 per B, equals	$.0045
Operation B—1.5 B's drilling	.007 per B, equals	.0105
Operation C— 2 B's shaping	.01 per B, equals	.0200
Standard Direct Cost		$.0350

Total Direct B's of work are
.5 plus 1.5 plus 2.0 equals 4, B's

4 × .00125 per Direct B equals Standard indirect Cost	$.005
Total Standard Labor Cost in Department A	$.040

The standard cost of the work done on the cover plate in any other department is determined in the same manner, evaluating each operation in turn and adding the proper indirect cost per direct B for that department.

The *actual* cost of a cover plate in any department is the standard cost, plus the percentage by which total costs exceed standard costs in that department as a whole. These excess costs are usually treated as a departmental condition, and, except in special cases, are not attributed to the specific parts on which they may actually have occurred, as would be the case with job costs. They usually consist of lost time, correction of bad work, losses from failure of operators to produce 60 B's per hour for their hourly pay, or surplus indirect help.

The total standard cost of one cover plate, is, of course, the sum of departmental standard costs for that part. The standard cost of the finished product is the sum of the standard costs of all parts involved, plus sub-assemblies and final assembly.

In Fig. 66 is reproduced an analysis sheet used by a well-known manufacturer. This Bedaux Analysis Sheet is primarily intended to present a graphic picture of departmental conditions which aids supervision in controlling costs, but it serves to exemplify the adaptation of the labor measurement of standard costing.

If this were our Department A, the actual cost of our cover plate would be

Period	Standard Cost	Percentage Excess	Actual Cost
7/15	$.04	32.0	$.0528
8/15	.04	17.2	.0469
9/15	.04	2.6	.0410

(The percentage excess cost column is outlined in Fig. 66.)

BEDAUX ANALYSIS

QUARTER 192–

Period	Number of Employees			Direct Labor			Sup. and Indirect Labor			Total Results					Total departmental effectiveness
1924	On standards men	Not on standards men	Total men	Bedaux units produced B's	Time spent hours	B hour	Standard allowance B's	Time spent hours	B hour	Total B's	Total time spent on stds. hours	B hour	Waste and losses hours	Time spent not on stds. hours	
3 Mos. Prev.	7.6		12.7	34,000	592.0	57.4	3,494	177.0	19.7	37,494	769.0	46.8	144.0	315.0	
7/15	3.1		3.5	13,994	212.5	65.7	1,470	76.2	19.3	14,830	286.7	51.4	75.6	35.9	
7/31	2.9		3.3	15,866	226.7	69.8	1,670	73.5	22.7	16,054	300.2	53.5	57.3	40.7	
8/15	2.9		3.5	15,448	243.0	63.6	1,634	58.4	28.0	17,082	301.4	56.7	16.40	68.0	
8/31	4.4		4.8	25,949	381.0	68.1	2,743	79.7	34.5	28,692	460.7	62.3	46.72	46.6	
9/15	5.4		5.7	36,656	514.4	71.1	3,878	72.8	53.3	40,534	587.2	69.2	16.20	28.4	
9/30	7.5		7.9	46,035	693.4	67.4	4,877	124.7	39.1	50,912	818.1	62.3	61.60	47.0	
10/15	7.3		7.5	48,305	703.2	68.7	5,108	95.4	53.5	53,413	798.6	66.9	24.90	29.1	

Period	Pay Roll			Payroll Direct Labor			Payroll Sup. and Ind. Labor			Total Payroll Analysis					
1924	% on standards	% not on standards	Total	Standard	Actual	% excess over std.	Standard	Actual	% excess over std.	Standard	Actual	% excess over std.	Waste and losses	Not on standards	
3 Mos. Prev.	61.9		754.20	283.50	348.50	65.80	20.10	113.54	84.40	311.60	461.30	48.0	149.40	284.20	25.0
7/15	91.0		207.15	118.05	124.73	6.68	14.00	49.80	35.80	132.05	174.53	32.0	42.48	22.62	35.0
7/31	84.0		209.80	127.08	130.86	5.78	16.50	54.40	47.90	143.58	185.26	29.0	41.68	24.54	38.0
8/15	79.7		201.98	120.78	121.68	0.90	17.51	39.40	21.89	138.29	161.06	17.2	22.79	40.90	47.0
8/31	91.3		302.42	219.37	225.22	5.85	27.69	50.60	23.11	247.06	276.02	11.7	28.96	26.40	55.0
9/15	95.7		376.30	315.90	319.54	3.64	35.17	40.57	5.40	351.07	360.11	2.6	9.04	16.19	67.5
9/30	95.1		505.98	406.37	414.74	8.37	39.32	67.37	28.05	445.67	481.11	8.2	36.42	24.87	57.0
10/15	96.8		504.25	529.19	436.45	7.26	46.40	52.09	5.69	475.59	468.54	2.7	12.95	15.71	65.0

FIG. 66.

Frank Bangs FOREMAN

Date 1926	Total number of people	Operators below normal	Hours of Direct Labor: On Bedaux work	Lost or allowed	On day work	Total	B's of Direct Labor: Direct B's produced	Day work minutes	% day work	Bad work B's deducted	Gross direct B's 342,880	Direct labor, B hour	Indirect Labor: Indirect hours	Indirect B's 1:6	Indirect labor, B hour	Total Labor: Total hours	Total B's 398,190	Total, B hour
Ref'nce	89	67	3,753	?	...	3,753	149,700	.....	...	...	149,700	40	1,240	24,150	19	4,993	173,850	35
July 25	71	10	2,482	248	19	2,749	193,879	1,140	0.6	...	195,019	71	1,274	31,454	25	4,023	226,473	56
Sept. 19	79	6	4,127	147	56	4,330	352,057	3,360	0.9	...	355,417	82	895	57,100	64	5,225	412,517	79
Oct. 17	85	8	4,077	187	63	4,327	358,391	3,810	1.3	...	362,201	84	831	58,400	70	5,158	420,601	82
Dec. 19	59	0	2,541	82	55	2,678	222,726	3,300	1.0	...	226,026	85	557	36,400	66	3,235	262,426	81
1928																		
July 1	187	10	10,194	681	205	11,080	896,473	12,258	1.4	594	908,137	83	883	64,900	74	11,963	973,037	81

Date 1926	Pay Roll: Direct labor pay roll	Indirect labor pay roll	Total pay roll	Standard total pay roll	% total excess	Cost per 1,000 B's: Direct 7.17	Excess direct cost	Indirect 1.21	Total 8.38	Dep't Effectiveness	Premium B's per hour	Premium Earned by Indirect: Bangs No. 1	Ritchia No. 2	Monta No. 3	Blair No. 4	Toque No. 4	Mella No. 5	Phillips No. 6	Kircher No. 7
Ref'nce	1,724.54	727.54	2,452.08	1,241.01	95	11.52	61	4.86	16.38	18									
July 25	1,556.72	750.45	2,307.17	1,634.10	41	7.98	12	3.84	11.82	40									
Sept. 19	2,631.68	552.52	3,184.20	2,978.34	7	7.41	3	1.56	8.97	73	19	1,525	1,016	565	510	406	662	610	509
Oct. 17	2,719.63	528.69	3,248.32	3,035.24	7	7.50	4	1.46	8.96	76	21	1,760	1,175	1,060	762	762	704	647	588
Dec. 19	1,694.78	373.93	2,068.71	1,894.10	4	7.49	4	1.24	8.73	78	22	1,935	1,155	1,040	712	796	691	655	578
1928																			
July 1	7,167.08	608.46	7,775.54	7,501.21	4	7.90	3	0.67	8.57	78	22	2,175	1,215	1,140	762	796	691	655	578

FIG. 67.

In Fig. 67, page 363, is the analysis sheet of another manufacturer using Bedaux control where conditions permit costing on the basis of the average cost per 1,000 B's.

(The standard cost per 1,000 column is outlined.)

If this second analysis sheet represented our Department A, then the cost of our cover plate would be

Period	Total direct B's	Cost per 1,000 B's	Actual cost per cover plate
7/25	4	$11.82	$.0473
9/19	4	8.97	.0359
12/19	4	8.73	.0349

Machine Set-ups.

When machine set-ups are of no particular importance, either as to amount of work involved or as to frequency of occurrence, they are often included as an item of indirect labor and treated as an activity bearing an average relation to the volume of production.

If, however, the number of such machine setups is large, or if each set-up involves considerable expense, they are more likely to be measured accurately in B's and treated as a direct-labor operation. The B's per piece would be determined by the B's required for one set-up, and the normal number of pieces in a run, or, for still greater accuracy, by the actual number to be run for the order under consideration.

Distributing Factory Expense.

Firms who have adopted Bedaux measurement in their costing, establish distribution of expense on the basis of total B's of direct labor, *which means actual volume of production.* As long as the production agrees with that taken as the basis for apportionment of expense, the actual amount of expense going into the costs is accurate, whereas, if distributed on the basis of direct hours or on direct-labor costs, the actual amount of burden distributed varies for the same production, according to fluctuations one way or another in the time taken to get out that production or the dollars spent to obtain it (see Chap. XIV, Methods of Distributing Factory Expense).

Standard Costs Applied to a Shop Accounting System.

A further practical example of standard cost is given in the following diagram, illustration and problem drawn up by A. J.

DIAGRAM OF THE SHOP ACCOUNTING SYSTEM

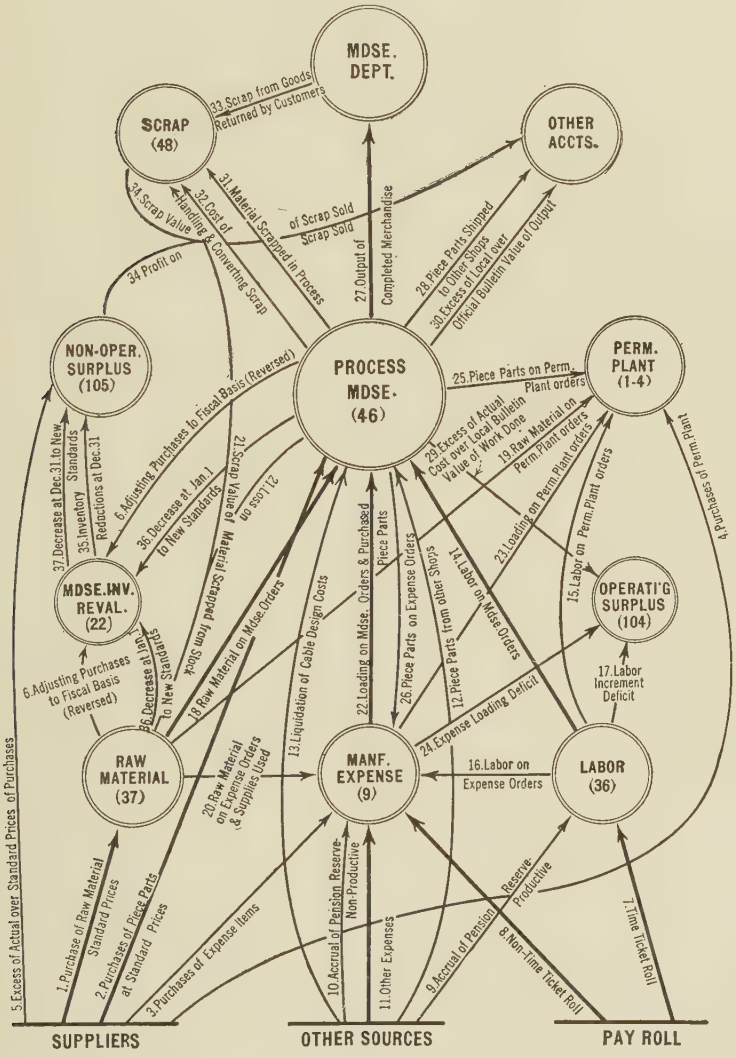

MDSE. DEPT.
SCRAP (48)
OTHER ACCTS.
NON-OPER. SURPLUS (105)
PROCESS MDSE. (46)
PERM. PLANT (1-4)
MDSE.INV. REVAL. (22)
OPERATI'G SURPLUS (104)
RAW MATERIAL (37)
MANF. EXPENSE (9)
LABOR (36)
SUPPLIERS
OTHER SOURCES
PAY ROLL
33.Scrap from Goods Returned by Customers
31.Material Scrapped in Process
32.Cost of Handling & Converting Scrap of Scrap Sold
34.Scrap Value of Scrap Sold
34 Profit on
27.Output of Completed Merchandise
28.Piece Parts Shipped to Other Shops
30.Excess of Local over Official Bulletin Value of Output
25.Piece Parts on Perm. Plant orders
29.Excess of Actual Cost over Local Bulletin Value of Work Done
19.Raw Material on Perm.Plant orders
23.Loading on Perm.Plant orders
15.Labor on Perm.Plant orders
4.Purchases of Plant
6.Adjusting Purchases to Fiscal Basis (Reversed)
37.Decrease at Dec.31 to New Standards
35.Inventory Reductions at Dec.31
36.Decrease at Jan.1 to New Standards
21.Scrap Value of Material Scrapped from Stock
21.Loss on
6.Adjusting Purchases to Fiscal Basis (Reversed)
36.Decrease at Jan.1 to New Standards
18.Raw Material on Mdse.Orders
22.Loading on Mdse. Orders & Purchased Piece Parts
26.Piece Parts on Expense Orders
14.Labor on Mdse.Orders
12.Piece Parts from other Shops
17.Labor Increment Deficit
24.Expense Loading Deficit
13.Liquidation of Cable Design Costs
20.Raw Material on Expense Orders & Supplies Used
16.Labor on Expense Orders
5.Excess of Actual over Standard Prices of Purchases
1.Purchase of Raw Material at Standard Prices
2.Purchases of Piece Parts at Standard Prices
3.Purchases of Expense Items
10.Accrual of Pension Reserve Non-Productive
11.Other Expenses
9.Accrual of Pension Reserve Productive
8.Non-Time Ticket Roll
7.Time Ticket Roll

Fig. 68.

Carlson, accounting expert of one of our largest electrical manufacturing companies. In this problem, Mr. Carlson stresses

points brought out in the earlier chapters of this text, namely, diagrammatic presentation and definite procedure. It is hoped this problem will give the student and the executive a concrete idea of the operation of standard costs (see Figs. 68 and 69).

Diagram of the Shop Accounting System

(Key to Chart)

1. Purchase of raw material to 37 account from suppliers.
2. Purchase of piece parts to 46 account from suppliers.
3. Purchase of Expense to 9 account from suppliers.
4. Purchase of Plant to 1–4 account from suppliers.
5. Excess of actual over standard prices of purchases from suppliers to Non-operating Surplus 105 account.
6. Adjusting purchases of raw material to fiscal basis from 37 to 22.
6. Adjusting purchases of piece parts to fiscal basis from 46 to 22.
7. Productive Labor from time tickets to 36 account from Payroll.
8. Non-productive Labor from roll to 9 account.
9. Accrual of Pension Reserve for Productive Employees to 36 account from other sources.
10. Accrual of Pension Reserve for Non-productive Employees to 9 account from other sources.
11. Other Expenses to 9 account from other sources.
12. Piece parts from other shops to 46 account from other sources.
13. Liquidation of Cable Design costs from other sources to 46 account.
14. Charge to 46 and credit to 36 for Labor on Merchandise orders.
15. Charge to Plant accounts and credit to 36 for Labor on Permanent Plant orders.
16. Charge to 9 account and credit to 36 for Labor on Expense orders.
17. Transferring Labor Increment Deficit from 36 account to Operating Surplus (104).
18. Charge to 46 and credit to 37 for raw material used on Merchandise orders.
19. Charge to Permanent Plant accounts and Credit to 37 for raw material used on Plant orders.
20. Charge to Expense accounts and credit to 37 for raw material used on Expense orders and Supplies used.
21. Difference between raw material value and scrap value charged to 46 account and credited to 37 account.
21. Charge to 48 (Scrap) account and credit to 37 at scrap value of Material Scrapped from Stock.
22. Loading on Merchandise orders and purchased piece parts charge to 46 account and credit to 9 account.

23. Loading on Permanent Plant orders charged to Plant accounts and credit to 9 account.

24. Closing out Expense Deficit from 9 account to Operating Surplus (104) account.

25. Charging Plant accounts and crediting 46 with piece parts used on Plant orders.

26. Charge to 9 account and credit to 46 account for piece parts used on Expense orders.

27. Charge to Merchandise department and credit to 46 account for Output of Completed Merchandise.

28. Charge to other accounts and credit to 46 account for piece parts shipped to other shops.

29. Transferring to Operating Surplus (104) account excess of Actual Cost over Local Bulletin Cost of Work Done.

30. Transferring to other accounts Excess of Local over Official Bulletin Value of Output.

31. Charging Scrap (48) account and crediting Process Merchandise (46) account with Material Scrapped in Process of Manufacture.

32. Charging Scrap (48) account and crediting Process Merchandise (46) account with Cost of Handling and Converting Scrap.

33. Charging Scrap (48) account and crediting merchandise department with Scrap from Goods Returned by Customers.

34. Charging other accounts and crediting Scrap (48) account with Scrap Sold.

34. Charging other accounts and crediting Non-operating Surplus (105) account with Profits on Scrap Sold.

35. Charging Non-operating Surplus (105) account and crediting Merchandise Invoice Revaluation (22) account with Reduction to Fair Market Value and other adjustments to Inventories at Dec. 31.

36. Charging Merchandise Invoice Revaluation (22) account and crediting Process Merchandise (46) account with Decrease in piece parts and Local Bulletins at Jan. 1.

36. Charging merchandise Invoice Revaluation (22) account and crediting raw material (37) account with decrease in raw materials Standards at Jan. 1.

37. Charging Non-operating Surplus (105) account and crediting Merchandise Invoice Revaluation (22) account with decrease at Dec. 31 to New Standards.

ILLUSTRATION OF SHOP-ACCOUNTING SYSTEM

1. Purchases of Raw Material at Standard Prices.

This transaction is made at what are known as standard prices. For example, if we were to charge at actual prices, the operating figures would be distorted by fluctuations in market prices. For this reason, a standard price is determined for each item of material, which price is used in the

operating accounts instead of the actual price paid. This transaction covers not only raw material to be used on the jobs, but also standard expense supplies which are carried in stock and later drawn out as used. We will assume certain arbitrary figures below:

	Actual prices paid	Standard prices	Difference
Raw Material Proper.....	$3,150	$3,000	$150
Standard Expense Supplies.	1,050	1,000	50
	$4,200	$4,000	$200

Based on the above, we will credit Supplier's and debit Raw Material with $4,000.

2. Purchases of Piece Parts at Standard Prices.

By piece parts is meant such material as does not come to us in a raw stage but has some operations already performed on it and is therefore thrown directly into Process Merchandise account. We will assume the following figures:

	Actual prices paid	Standard prices	Difference
Piece parts.....	$6,300	$6,000	$300

Based on the above we make a debit to Process Merchandise and a credit to Supplier's of $6,000.

3. Purchases of Expense Items.

These items are charged into the operating accounts at actual prices paid since many of them are not standard and it would be impossible to set standard prices on them. We will assume that this amounts to $1,000. We will therefore credit Supplier's and charge Manufacturing Expense with this amount.

4. Purchases of Permanent Plant.

This transaction is also made at actual prices paid. We will assume an amount of $400, which we will credit Supplier's and debit Permanent Plant.

5. Excess of Actual over Standard Prices of Purchases.

This refers to the difference between actual prices paid and standard prices used in transactions 1 and 2, which amounts to $500. This amount is credited to Supplier's and charged to Non-operating Surplus account, since this amount is not due to operating conditions.

6. Adjusting Purchases to Fiscal Basis.

Since the Company's accounting is done on a calendar month basis, that is, from the first to the last day of the month, and since the manufacturing department's accounting is done on a fiscal month basis, that is, on equal

4- or 5-week months, some reconciliation must be made of such items, as purchases which are on a calendar basis when they affect the operating accounts to any extent. We will assume that the amount of purchases on a calendar month basis exceeds what it would be on a fiscal month basis by $100 each for Raw Material and Process Merchandise accounts. This item is credited to these accounts and charged to Merchandise Inventory Revaluations account. At the first of the following month this item is reversed to give the proper adjustment at the beginning of the month.

7. Time Ticket Roll.

This transaction covers the wages paid to shop employees whose time is accounted for against some job by means of time tickets. It is divided into two classes; (1) Direct Labor and (2) Indirect Labor. The former covers those wages which can be definitely charged to some productive job, where the latter covers wages paid to these employees such as overtime allowances, vacation allowances, etc., which cannot be directly charged to an order but must be pro-rated over the cost of all productive orders on a percentage basis. We will assume these figures are as follows:

Direct Labor	$3,000
Indirect Labor	200
Total	$3,200

Based on the above, Payroll account is credited and Labor account is charged.

8. Non-time Ticket Roll.

This covers salaries paid to employees whose time cannot be associated with individual jobs in the shop and represents usually salaried employees. We will assume that this amounts to $1,000 which we will credit Payroll and charge Manufacturing Expense.

9. Accrual of Pension Reserve: Productive.

This reserve is accrued to set up sufficient funds to meet pension payments in the future. It is determined by applying a percentage to the value of the productive payroll. We will assume that this amounts to $60 which we will credit to the Broadway Office and charge to Labor account.

10. Accrual of Pension Reserve: Non-productive.

This covers the same as the previous item except that it is for non-productive employees and is determined in about the same manner. We will assume that this amounts to $30 which we will credit to the Broadway Office and charge to Expense.

11. Other Expenses.

We are grouping, for convenience, all other expenses where it is not necessary as far as this subject is concerned, to go into detail. Some of the larger items are depreciation on permanent plant, taxes, insurance, services

received from other organizations, etc. We will assume that this amounts to $500 which is credited to the proper accounts and charged to Manufacturing Expense.

12. Piece Parts from Other Shops.

Quite a number of piece parts are made in one of the Works and not at any of the other locations so that transfers are made between the Works for such piece parts as they may require from each other. We will assume that this amounts to $1,000 which is credited to the proper Works and charged to Process Merchandise account, the same as piece parts purchased.

13. Liquidation of Cable Design Costs.

This item covers drafting and certain engineering work done by the Equipment department and it is realized in costs by applying percentages to the value of work on the classes of jobs in the shop affected. The amount realized on this percentage basis is credited to the Equipment department and charged to Process Merchandise account.

14. Labor on Merchandise Orders.

We have now reached a point where we shall distribute the labor charged to Labor account to the accounts against which are classified the various jobs in the shop. This transaction is based on time tickets in the case of Direct Labor and on a percentage basis in the case of Indirect Labor. We will assume that the portion covering work done on merchandise jobs (that is, on work covering the manufacture of a product to be sold) amounts to $1,950 for Direct Labor (based on time tickets) and $180 for Indirect Labor (based on percentages known as "Labor Increment Rates"). The total of these two, $2,130, is credited to Labor account and charged to Process Merchandise account.

15. Labor on Permanent Plant Orders.

This covers work in connection with the manufacture of buildings, permanent fixtures, and machinery by our employees to be used by us in the manufacture of merchandise. We will assume that this amounts to $500 for Direct Labor and $40 for Labor Increment (Indirect Labor) or total of $540 which is credited to Labor account and charged to Permanent Plant accounts.

16. Labor on Expense Orders.

This covers work on orders which can neither be kept by us as plant nor sold as merchandise such as, repairs. We shall assume that this amounts to $500 for Direct Labor and $15 for Labor Increment or total of $515 which is credited to Labor account and charged to Manufacturing Expense account.

17. Labor Increment Deficit.

This covers (1) the difference between actual indirect labor and labor increment, (2) differences due to lost time tickets, clerical errors, etc. We

will tabulate below the various transactions already covered which affect this item:

	Direct Labor	Indirect Labor	Total
Item 7, Time Ticket Roll	$3,000	$200	$3,200
Item 9, Accrual of Pension Reserve, Productive	.....	60	60
Total Charged to Labor Account	$3,000	$260	$3,260
Item 14, Labor on Merchandise Orders	$1,950	$180	$2,130
Item 15, Labor on Permanent Plant Orders	500	40	540
Item 16, Labor on Expense Orders	500	15	515
Total Credited to Labor Account	$2,950	$235	$3,185
Labor Increment Loss	$ 50	$ 25	$ 75

This loss is cleared out of Labor account by crediting this account and charging Operating Surplus account.

18. Raw Material on Merchandise Orders.

We are now to the point where we are about to distribute raw material as it is used on the various jobs in the shop. This distribution is based on draw tickets which are issued for each lot of material drawn from stock. We will assume that for merchandise jobs this amounts to $2,000 which we shall debit to Process Merchandise account and credit to Raw Material account. It is obvious that this item is at standard prices.

19. Raw Material on Permanent Plant Orders.

We will assume that the raw material used in connection with the manufacture of Permanent Plant amounts to $200 which is debited to Permanent Plant accounts and credited to Raw Material account.

20. Raw Material on Expense Orders and Supplies Used.

This really covers two main transactions. The first which covers raw material used on expense jobs, such as repairing, we shall assume to be $100 which is debited to Manufacturing Expense and credited to Raw Material account. The second transaction covers Expense Supplies such as stationery, fuel, oil, etc., which is standard and is therefore stocked until drawn out for use. At the time it is drawn out an entry is made debiting Manufacturing Expense and crediting Raw Material. We will assume that this amounts to $500.

21. Material Scrapped from Stock.

This covers such material and supplies which become obsolete or damaged while in the storerooms. In order to properly adjust the Raw Material account for this loss, the good value of such material is credited to Raw Material account, we shall say at $50. However, only the scrap value is

charged to Scrap account which we shall assume is $20 and the balance which is a complete loss is charged to Process Merchandise account as an item to be later gotten back in cost of merchandise.

22. Loading on Merchandise Orders and Purchased Piece Parts.

By loading is meant the amount realized in costs through the application of loading rates, that is, a fixed amount per hour to cover Manufacturing Expense. This item really covers two transactions. The first has to do with loadings applied to cover work done on merchandise orders. We will assume that this amounts to $2,500 which item is debited to Process Merchandise account and credited to Manufacturing Expense account. The second transaction covers the loading applied to value of piece parts purchased to cover ordering, handling, receiving, storing, etc., of purchased piece parts. We will assume this item to amount to $200 which is also debited to Process Merchandise account and credited to Manufacturing Expense account.

23. Loading on Permanent Plant Orders.

We will assume that this amounts to $600 which is credited to Manufacturing Expense account and debited to Permanent Plant accounts.

24. Expense Loading Deficit.

This covers the difference between actual expense incurred and that realized in cost by the application of loading rates. A summary of items 3, 8, 10, 11, 16, 20 and 26, shows that expenses incurred amounted to $3,745, while the amount realized in cost through the application of loading rates as shown by items 22 and 23, amounted to $3,300 which means that we failed to realize in costs, $445. This item is a loss and must be cleared out of the operating accounts. This is done by crediting Manufacturing Expense account and charging the Operating Surplus account.

25. Piece Parts on Permanent Plant Orders.

We will assume that this amounts to $150 and since piece parts when purchased are charged to Process Merchandise account, this transaction will be a credit to the latter account and a debit to Permanent Plant accounts.

26. Piece Parts on Expense Orders.

Similarly, piece parts used on expense jobs are credited to Process Merchandise account and charged to Manufacturing Expense account, which we will say amounts to $100.

27. Output of Completed Merchandise.

This transaction covers the crediting to shop accounts and the charging to Merchandise Department accounts for completed work delivered to them. This is at a fixed price for a unit delivered which is known ordinarily as a bulletin cost. However, there are two kinds of bulletins, local bulletin and official bulletin. Local bulletin costs are based entirely on costs of the

local works. However, it would not be fair for a customer receiving merchandise from one of our plants to be billed at possibly a higher value than a customer receiving merchandise from another of our plants because of difference in local bulletins at each works. For this reason, an official bulletin is figured which represents theoretically an average of the several works. We will assume that the local cost is $5,300 but that the official cost is $5,100. The value to be used in this transaction is $5,100 which is credited to Process Merhandise account and charged to Merchandise Department.

28. Piece Parts Shipped to Other Shops.

We have seen before, under item 12, that piece parts are transferred between works as required. This item covers such piece parts which one plant makes for other plants. This item is credited to Process Merchandise account and charged to Other works. We shall assume that this amounts to $400.

29. Excess of Actual Cost over Local Bulletin Value of Work Done.

This item clears Process Merchandise account for the difference between actual labor, material, and loading charged to this account and the standard local bulletin value of work produced whether completed or process. We will assume that this amounts to a loss of $150 which is credited to Process Merchandise account and charged to Operating Surplus account.

30. Excess of Local over Official Bulletin Value of Output.

Under item 27, we saw that there were two kinds of bulletin, local and official. In billing the merchandise for output of completed work, we must use the Official Bulletin Cost. This leaves a difference between the local and official which we saw was $200. This loss must be cleared out of Process Merchandise account by crediting this account and charging Manufacturing Headquarter's account who maintain a sort of a pool of losses and surpluses at the various works due to differences between local and combined bulletins.

31. Material Scrapped in Process.

In the process of manufacture, a certain amount of material and piece parts are spoiled which is cleared out of Process Merchandise account at scrap value and charged to Scrap account. We shall assume that this amounts to $60.

32. Cost of Handling and Converting Scrap.

This item covers the time and expense of handling and converting scrap so that it can be resold to junk dealers. These charges had originally been charged to Process Merchandise account so that this account must be credited and Scrap account charged. We shall assume that this amounts to $25.

33. Scrap from Goods Returned by Customers.

We shall not go into much detail on this subject except as it affects Scrap account. On goods returned by customers a certain amount is turned into

scrap and sold to junk dealers. This transaction covers the credit to the Merchandise department and the charge to Scrap account for the scrap value of such goods returned which we shall assume to be $50.

34. Scrap Sold.

So far, Scrap account has been charged only at standard scrap value and standard cost of handling and converting. Therefore, to keep our Scrap account clear, only the standard value plus a certain amount for handling and converting can be credited to Scrap account which we shall say amounts to $100. However, we may receive a higher price than this from the junk dealers which we shall assume to be $120. The excess of $20 which represents a profit is credited to Non-operating Surplus account.

35. Inventory Reductions at Dec. 31.

It is always good accounting practice to reduce the inventories at the end of the year by any anticipated reductions that may take place later on. However, rather than to distort our operating accounts with such reductions, they are credited to Merchandise Inventory Revaluations account and charged to Non-operating Surplus account. We shall assume this amounts to $25. This naturally is reversed again in the following year.

36. Decrease at Jan. 1 to New Standards.

In reality, item 37 logically comes before 36. As seen, in item 37, no reductions are made at the end of the current year to the regular operating accounts for reduced standard prices. At the first of the new year, however, these operating accounts must be adjusted so that the beginning inventory will be on the new basis. This transaction should be the same value as 37 which we shall assume to be $30 for Process Merchandise account and $20 for Raw Material account which accounts are credited while the total of $50 is charged to Merchandise Revaluations account which had been previously credited with this item.

37. Decrease at Dec. 31 to New Standards.

Standard prices which have already been discussed are frequently changed. These changes are made effective with the beginning of the new year. However, as a conservative accounting practice, any losses because of reductions in prices, are taken at the end of the current year. However, we don't wish to distort the operating accounts during the current year since all transactions for the year should be at the same price levels. For this reason, we credit Merchandise Inventory Revaluations account instead, which we have assumed under item 36 to be $50. This is debited to Non-operating Surplus account. As a matter of interest, Merchandise Inventory Revaluations account is an account which takes care of adjustments applying to Operating Inventory accounts, but which are beyond the Local Management' scontrol. At the main office, for Company balance sheet purposes, however, this account is combined with the inventory accounts.

The transactions shown under T accounts assume that there had been no previous balances and must be looked upon in that light.

Raw Material account has a debit balance of $1,030 which represents the inventory of raw material and supplies on hand at the end of the period.

DIAGRAM OF ACCOUNTS

Transactions	Suppliers	Pay Roll	Other Sources	Raw Material	Manufacturing Expense	Labor	Process Merchandise	Permanent Plant	Operating Surplus	Non-Operating Surplus	Merchandise Inventory Revaluations	Merchandise Department	Scrap	Other Accounts
1. Purchases of Raw Material at Standard Prices	$ 4,000			$4,000										
2. Purchases of Piece Parts at Standard Prices	6,000						$6,000							
3. Purchases of Expense Items	1,000				$1,000									
4. Purchases of Permanent Plant	400							$ 400						
5. Excess of Actual over Standard Prices of Purchases	500									$500				
6. Adjusting Purchases to Fiscal Basis (Reversed)				$ 100			$ 100				$200			
7. Time Ticket Roll		$3,200				$3,200								
8. Non Time Ticket Roll		1,000			1,000									
9. Accrual of Pension Reserve—Productive			$ 60			60								
10. Accrual of Pension Reserve—Non-Productive			30		30									
11. Other Expenses			500		500									
12. Piece Parts from Other Shops			1,000				1,000							
13. Liquidation of Cable Design Costs			200				200							
14. Labor on Merchandise Orders						$2,130	2,130							
15. Labor on Permanent Plant Orders						540		540						
16. Labor on Expense Orders					515	515								
17. Labor Increment Deficit						75			$ 75					
18. Raw Material on Merchandise Orders				2,000			2,000							
19. Raw Material on Permanent Plant Orders				200				200						
20. Raw Material on Expense Orders				100	100									
Supplies Used				500	500									
21. Material Scrapped from Stock				50			30						$20	
22. Loading on Merchandise Orders					2,500		2,500							
Loading on Purchased Piece Parts					200		200							
23. Loading on Permanent Plant Orders					600			600						
24. Expense Loading Deficit					445				445					
25. Piece Parts on Permanent Plant Orders							150	150						
26. Piece Parts on Expense Orders					100		100							
27. Output of Completed Merchandise							5,100					$5,100		
28. Piece Parts Shipped to Other Shops							400							$400
29. Excess of Actual Cost over Local Bulletin Value of work done							150		150					
30. Excess of Local over Official Bulletin Value of Output							200							200
31. Material Scrapped in Process							60						60	
32. Cost of Handling and Converting Scrap							25						25	
33 Scrap from Goods Returned by Customers												$50	50	
34. Scrap Sold										$20				$100 120
35. Inventory Reductions at December 31										25	$25			
36. Decrease at January 1, to New Standards				20			30				50			
37. Decrease at December 31, to New Standards										50	50			
Balance	$11,900	$4,200	$1,790	$1,030			$7,745	$1,890	$670	$555	$175	$5,050	$55	$720

FIG. 69.

Manufacturing Expense account and Labor account have no balances at the end of the month since these factors must be disposed of either in costs or through transfers of losses.

Process Merchandise account has a debit balance of $7,745 which represents the inventory of piece parts and work in process on hand at the end of the month.

Operating Surplus has a balance of $670 which represents losses within the control of the Local Management.

Non-operating Surplus account has a balance of $555 which represents losses outside the control of the Local Management. Both of these accounts are cumulative until the end of the year when their balances are closed out to Profit and Loss account.

Merchandise Inventory Revaluations account has a debit balance of $175 which is added to Raw Material and Process Merchandise accounts at New York when making up Company balance sheet. However, the adjustments represented by this account are of no interest whatsoever to the Local Management and would only distort comparisons that they would be interested in. The balance of $55 in Scrap account represents the inventory of scrap on hand which has not yet been disposed of or sold. (See Fig. 69 for Diagram of Accounts.)

Further Diagrammatic Standard Cost Plans.

Probably the most complete work on Standard Cost are the writings and diagrams of G. Charter Harrison. The reader is referred to his excellent work on this subject published in a series of articles appearing in *Manufacturing Industries* beginning September, 1927, page 193, entitled "Installing Standard Costs."

SUMMARY

In Chap. XVII, the following accounting points were emphasized:

1. Standard costs are an extension of the scientific management principle to cost accounting.
2. In establishing a standard cost system a survey of the industry under consideration must be made.
3. Standard costs are sometimes referred to as bulletin costs.
4. In accounting procedure variations from standard are debited or credited to a variance account.
5. Standard costs make it possible to
   - *a.* Establish accurate sales quotas.
   - *b.* Establish accurate manufacturing "bogies."
   - *c.* Gage the efficiency of manufacturing and selling.
   - *d.* Budget the expense of all divisions.
   - *e.* Economize on clerical effort.

CHAPTER XVIII

BUDGETARY CONTROL

OBJECT OF CHAPTER: To study the application of the budget principle to a manufacturing industry.

The Budget System a Coordinated Plan of Control.

It is the aim of a budget system to present a coordinated plan of operation for the immediate furture. By the use of such a system the manufacturing executive will in a large measure be able to plan in detail the aims of his organization in regard to sales, and to control in detail all activities involving the expenditure of funds.

While a system of budgetary control is not in any way expected to replace able and skilled executives, its purpose is to reconcile and coordinate their efforts. It will aim to obtain from them definite promises of accomplishment from which may be set definite goals. With such definite incentives to strive for, competitive spirit may be created, because the accomplishment of certain fixed objectives is a real criterion of good executive ability.

While the budgetary principle is not new, its application to manufacturing is of comparatively recent date.

Figure 70 shows the relation of the various budgets of a manufacturing company beginning with the natural starting point, the sales budget.

The sales department will make monthly estimates of sales based on previous experiences, seasonality trend, and by the use of various forecast information. From this information the works manager will be able to set up the production budget. The planning department, in turn, may analyze this budget and establish definite production schedules for the month. Such analyses will reveal the amount of raw material required, labor needed to manufacture the product, and manufacturing expense necessary, and lead to the establishment of the *Material Budget*, the *Direct Labor Budget* and the *Manufacturing Expense Budget.*

The works manager will draw up the *Budget for New Equipment*, the sales manager the *Selling Expense Budget* and the *general manager* or his assistant the *Administrative Expense Budget.*

All budget estimates then come before the general manager or a committee on budgetary control who synthesize all budgets into the *Financial Budget.* From this compilation of estimated receipts and expenditure it is possible to draw up estimated

CHART OF BUDGETARY CONTROL

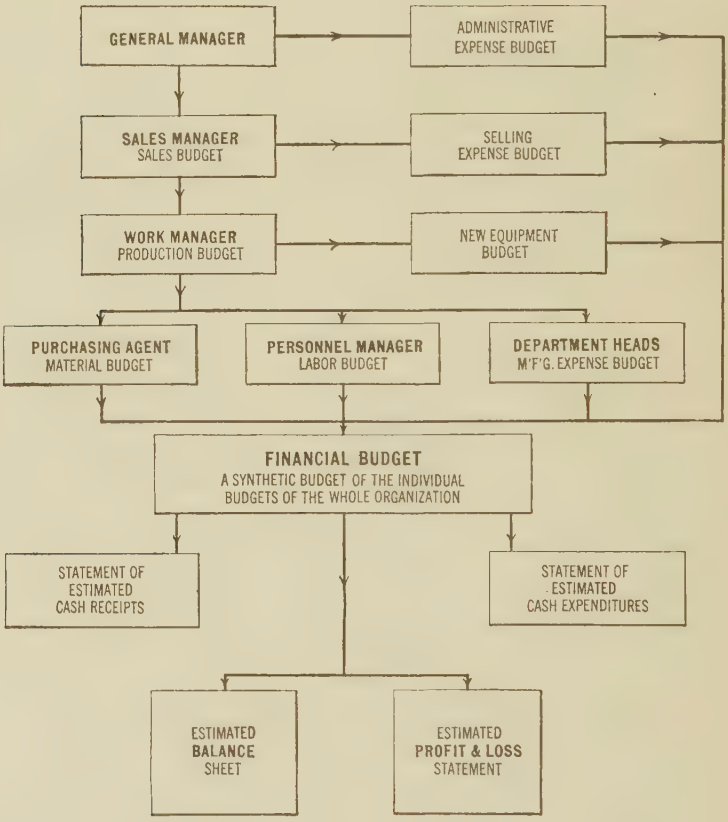


FIG. 70.

financial statements, the most important of which are (1) the statement of estimated cash receipts, (2) the statement of estimated cash expenditures, (3) the estimated balance sheet, and (4) the estimated profit and loss statement (see Figs. 73 and 74).

Budgetary Control of Factory Expense (see Chap. XIV).

It has been pointed out before that the hardest element to control is that of factory expense. While it is fairly easy to

keep the factors of direct labor and material under very close control, by means of wage incentive system and manufacturing layouts, factory expense as a rule is very much harder to control. The following scheme used by a large electrical manufacturing industry illustrates a well-formulated plan.

It is necessary, first, to determine which departments in the organization are responsible for the various functions. A classification system is set up whereby the expense is properly reported against the department which incurs it. The head of the department is, therefore, charged only with the expenses which he can control, for it is he who authorizes their expenditure.

The volume of business may change from that originally expected when compiling the budget, thereby necessitating the spending of more or less money. In order not to compile new budgets each time the volume of business changes, it is desirable to make the budget originally set up flexible, so that it can be easily adjusted to fit the volume of business.

The rate or volume of business referred to above, is called "activity." In order to measure this activity or volume of business, there must be used some convenient and logical unit of measurement, such as value of output, number of productive employees, value of productive labor, productive or machine-hours, etc.

In order to express the volume of business or activity on a percentage basis, there must be determined normal activity which will be known as 100% activity. This normal is determined as follows:

A full working week consists of 48 hours; that is, each machine or bench position can be run 48 hours per week, not counting overtime. Allowing for approximately 1 week of holidays in the year, we say there are 51 weeks in a year. At 48 hours a week, this will amount to 2,448 hours per year. This we call "capacity." However, machines and bench positions are idle because of breakdown, repairs, absences of employees, etc. Based on studies made over a long period of years, it is estimated that this idleness amounts to about 20% of the capacity of the machine leaving 80% which is called normal or 100% activity, or 1,958 hours per year. The sum of the normals of all productive machines or bench positions throughout the works represents the normal activity of the works, expressed in hours. One class of work, however, is cheaper to operate than another class

and, for this reason, the normal hours of each machine or bench position are weighed by the proper expense rate for that position. The total of this throughout the works will represent "normal loading returns." To arrive at the actual activity for any period, the relationship is found of the actual loading returns for that period to the normal loading returns.

Constant and Variable Expense.

An increase of 25% in the volume of business or activity does not necessarily require a corresponding increase in the expense budget. Certain expenses such as "salaries of foremen" remain fixed for any activity. For this reason it is necessary to divide the budget into two portions known as "constant expenses" and "variable expenses." Determining the relationship of constant and variable for the various organizations requires the combined experience of the foreman of an organization and the accountant.

Method of Setting a Budget.

The first information necessary in setting a budget for the coming year is to know the rate of actual expenditures for the present year. To this, is added or subtracted increases not due to activity and decreases because of more efficient methods. This will leave a budget at the present rate of activity. It is necessary to adjust this budget to a normal basis, that is, what would be spent at normal or 100% activity. This is done by dividing the budget at activity by the following formula:

$$C + (V \times A).$$

Where C is the percentage of the constant portion at normal activity, V is the percentage of the variable portion at normal activity, and A is the percentage of present activity. This will give a budget at normal activity. Based on estimates from the sales organization reduced to terms of expense, it is possible to estimate percentage of activity for the coming year. The variable portion of the normal budget is adjusted to that activity and the constant portion added to it. This procedure is illustrated in Problem 1.

Problem 1. Normalizing a Budget at Activity.

Given:

1. Budget at activity, $21,200
2. Percentage of this activity, 110%
3. Relation of constant and variable:
   Constant, 40%.
   Variable, 60%.

to arrive at budget at normal activity.

Solution.

$$\$21,200 \div [.40 + (.60 \times 1.10)] \text{ or } \$21,200 \div 1.06$$

or

$20,000 = Normal budget
$ 8,000 = Constant (40%)
$12,000 = Variable (60%).

1927 NORMAL EXPENSE BUDGET

FOR _____ ORGANIZATION NO. _____

CLASS OF EXPENSE	TOTAL NORMAL BUDGET			AT 19- ESTIMATED ACTIVITY (A)
	CONSTANT (B)	VARIABLE	TOTAL	
DEPRECIATION ON PERMANENT PLANT				
TAXES				
INSURANCE				
NON-PRODUCTIVE PAY				
CHANGES AND REPAIRS				
SUPPLIES AND EXPENSE TOOLS				
DEPREC. ON SMALL TOOLS				
OTHER DEPRECIATION				
OTHER DIRECT EXPENSE				
SERVICES RECEIVED				
TOTAL GROSS EXPENSE				
SERVICES RENDERED				
TOTAL NET EXPENSE				

(A) AT _____ % ACTIVITY

FIG. 71.

Figure 71 shows a normal expense budget form for carrying out the procedure.

Each month the budget is adjusted to the *actual activity* for that month and inserted on expense reports for comparison with the actual expense.

Estimated Statements.

Estimated statements are a logical development of budget making. The accounting department will, by the aid of the budget committee and the financial budget, be able to prepare estimated statements.

A typical procedure of this sort is illustrated by the following form used by a large metal products company.

ESTIMATED OPERATING STATEMENT YEAR, 1928

Net Sales:	
Class 1	$6,000,000
Class 2	900,000
Class 3	700,000
Class 4	400,000
Total	$8,000,000
Production Costs:	
Class 1	$3,600,000
Class 2	630,000
Class 3	420,000
Class 4	300,000
Total	$4,950,000
Gross Margin	$3,050,000
General and Selling Expense:	
Sales Expense	$ 400,000
General Expense	640,000
Advertising Class 1	400,000
Advertising Class 2	64,000
Advertising Class 3	40,000
Advertising Class 4	16,000
Total	$1,560,000
Net Margin	$1,490,000

FIG. 72.

An estimated operating statement shown in Fig. 72 consisting of Net Sales, Production Costs, and Sales and Administrative expenses is drawn up. This gives the estimated net margin of profits $1,490,000 on operation. Figure 73 illustrates the estimated Profit and Loss statement beginning with the figure $1,490,000 "net gain from operating statement and ending with $860,000 total available for surplus."

ESTIMATED PROFIT AND LOSS STATEMENT, YEAR 1928

Net Gain from Operating Statement		$1,490,000
Cash Discount Receivable		25,000
Dividends		20,000
		$1,535,000
Deduct:		
Net Interest Cost	$175,000	
Estimated Inventory Depreciation	350,000	
		525,000
		$1,010,000
Federal Taxes		150,000
Total Available for Dividends and Surplus		$ 860,000

FIG. 73.

ESTIMATED BALANCE SHEET

	Dec. 31, 1927	Estimated Changes	Estimated Dec. 31, 1928
Current:			
Cash	$ 20,000	$ 10,000	$ 30,000
Notes and Accounts Receivable, Less Reserve for Doubtful	1,250,000	100,000	1,350,000
Government Securities	1,400,000	(−400,000)	1,000,000
Inventory	3,000,000	500,000	3,500,000
	$ 5,670,000	.....	$ 5,880,000
Subsidiaries	900,000	(−50,000)	850,000
Investment and Other Assets	450,000	50,000	500,000
Deferred	450,000	25,000	475,000
Plant and Equipment, Less Depreciation	5,000,000	(−125,000)	4,875,000
Total Assets	$12,470,000	.....	$12,580,000
Liabilities			
Current and Accrued:			
Accounts Payable	$ 300,000	$ (−25,000)	$ 275,000
Accrued Taxes, etc	65,000	20,000	85,000
Reserve for Federal Taxes and Contingencies	200,000	(−25,000)	175,000
Funded Debt (notes)	1,150,000	.....	1,150,000
Capital Stock (preferred)	4,000,000	.....	4,000,000
Capital Stock (common)	6,000,000	.....	6,000,000
Surplus	755,000	[1]140,000	895,000
Total Liabilities and capital	$12,470,000	.....	$12,580,000

[1] $140,000 is the amount estimated available to be added to surplus, calculations for which are shown on p. 384.

FIG. 74.

In the preparation of these statements, the manufacturing cost of sales is calculated at the budget or standard cost. This gives a good check on the efficiency of production. Inventories are also calculated at standard cost.

The next development in budget making is the estimated Balance Sheet. In preparing this statement it is necessary to determine what portion of the available surplus shown on the estimated Profit and Loss Statement is to be distributed as dividends.

Let a capitalization of $10,000,000 be assumed. $4,000,000 is 6% preferred and $6,000,000 is 8% common stock.

Profit		$860,000
Less Dividends:		
Preferred 6%	$240,000	
Common 8%	480,000	720,000
Available to be added to surplus		$140,000[1]

This addition to surplus will appear as an increase in net assets, apportioned according to the best judgement of the company after estimates of Accounts Receivable, Inventory, Plant Changes, and Accounts Payable have been determined. The completed estimated Balance sheet is shown in Fig. 74.

Reports of Budget Realization.

In order to keep a close account of the actual expenditures against the standard set by the budget, the accounting department should send periodic statements showing just where each department stands. These reports are usually in great detail and are sent throughout the organization to the lowest unit for which a budget has been set. A constant stream of information of actual figures against the budget figures encourages many of the lower executives in their efforts to beat their budget. Many of these reports are for weekly periods and are issued in competetive form with other similar departments. Figure 75 is a typical example of such a report.

Advantages to Be Derived from Budgetary Control.

The major advantages obtained from the operation of a business on a budget basis may be listed as follows:

a. It permits planning ahead on a basis that will assure a reasonable chance to obtain the profit desired.

[1] See "Budgeting for Business Control," pp. 22 and 25 inc. Dept. of Manufacture, U. S. Chamber of Commerce.

Weekly Budget Report—Machining—For Week Ending

Item	Budget amount allowed	Jan. 7	Jan. 14	Jan. 21	Jan. 28	Feb. 4	Feb. 11	Feb. 18	Feb. 25
Supervision	$ 60.00	60.00	60.00	68.00	48.50	60.00	60.00	60.00	62.00
Overtime	.....	.....	.....	4.40	.....	.55	.....	.....	1.10
Furn. & Fixt. Maintenance	2.00	.....	8.40	.....	.....	.....	14.00		
Inspection	40.00	40.65	44.82	38.20	52.00	36.20	31.58	35.16	32.12
Idle Time	.....	16.20	2.45	3.18	6.45	.55	1.40	.....	6.00
Machine Maintenance	30.00	18.80	14.05	6.80	35.72	104.62	13.40	16.80	25.00
Clerical Work	.50	.....	.....	.85	.....	.....	3.60	.....	1.80
Set-up Time	50.00	32.64	38.45	72.17	60.12	50.81	79.98	26.44	38.72
Supplies	180.00	199.40	160.20	180.00	245.00	88.00	212.00	106.40	170.29
Direct Labor	1,240.00	1,300.50	1,190.00	1,224.46	1,260.08	1,255.47	1,220.20	1,305.60	1,270.11
Miscellaneous Labor	80.00	80.00	80.00	80.00	66.00	66.00	66.00	66.00	68.10
Tool Maintenance	25.00	14.66	29.40	22.60	34.18	53.59	14.60	38.40	10.80
Scrap	10.00	.....	39.00	1.80	4.80	6.80	11.00	3.60	5.14
Total Department Cost	$1,717.50	1,762.85	1,666.77	1,702.46	1,812.85	1,722.59	1,727.76	1,658.40	1,691.18
Total Std. Hrs. Pro.	2,160.0	2,170.4	2,104.0	2,140.8	2,210.1	2,155.0	2,195.0	2,120.6	2,185.5
Dept. Cost per Std. Hr.	0.795	0.814	0.791	0.795	0.820	0.800	0.788	0.781	0.772
Budget Efficiency—%	.....	97.8	100.5	100.0	97.0	99.5	101.0	102.0	103.1

Fig. 75.

b. Executive control is obtained over the internal operations of the business.

c. Sales and production plans may be coordinated with financial plans and resources.

d. Greater regularity of employment and reduction of cost may be obtained because of more uniform production schedules.

e. The definite assignment of responsibility for expenditures will increase operating efficiency.

f. Greater standardization and simplification of processes, equipment, and products.

g. Smaller inventories and quicker turnover.

h. Costs become live implements of control rather than historical information.

i. A better control over cash for wages, material invoices, etc.

j. A better economic operation of the business because expenses are studied before they are actually incurred.

k. A definite goal is given to every part of the organization.

l. The budget serves as a measuring stick to compare the standards with the actual performances.

SUMMARY

In Chap. XVIII, the following accounting points were emphasized:

1. The aim of budgetary control is to present a coordinated plan of action for the whole organization.

2. The principal budgets to be found in a manufacturing organization are, the Sales Budget, Production Budget, Material Budget, Labor Budget, Manufacturing Expense Budget, Administrative Expense Budget, Selling Expense Budget, New Equipment Budget, and the Financial Budget.

3. The Financial budget coordinates and synthesizes all other budgets.

4. Estimated statements are a logical development of budgetary procedure.

5. Realization reports checking actual against standard figures furnish valuable means of making the budget realistic.

CHAPTER XIX

ANALYSIS OF FINANCIAL STATEMENTS

OBJECT OF CHAPTER: (*a*) to study methods of Balance Sheet analysis; (*b*) to study methods of Profit and Loss Statement analysis.

Balance Sheet Analysis.

The analysis of financial statements, particularly the Balance Sheet, arose, without doubt, as a result of the natural need by credit men for detail information of the business to which they were extending credit or loans. A good thumb-and-hand rule for the extension of credit as expressed by a credit man of standing is, a 2 to 1 ratio of current assets to current liabilities, and a 10% profit on net sales.

Other tests have developed, all arising from the general experience of the credit field, and, today, these ratios are in general use by the credit man and accountant, as well as by the general manager himself.

TABLE OF MOST FREQUENTLY USED RATIOS

The following table is a summary of the most frequently used ratios:

Ratio	Generally Accepted Figure of Credit Men
1. Current ratio $= \frac{\text{Current Assets}}{\text{Current Liabilities}}$	2 to 1
2. Acid-test ratio $= \frac{\text{Current Asset—Inventories}}{\text{Current Liabilities}}$	1 to 1
3 Sales to Receivables ratio $= \frac{\text{Annual Sales}}{\text{Account Receivable}}$	12 to 1 for 30 days payment 6 to 1 for 60 days payment

4. Sales to Inventory ratio $= \dfrac{\text{Annual Sales}}{\text{Inventory}}$ — This is a turnover figure and must be checked against turnover figures within the business studied. The figure 3 for example would indicate that the inventory had turned over three times per year and that 4 months merchandise is on hand.

5. Cash to Current Liabilities ratio $= \dfrac{\text{Cash}}{\text{Current Liabilities}}$ — .20 to 1. This arises from the line of credit custom of some bankers, who demand a 20% cash balance be maintained for the size of cash loans extended to their clients.

6. Various general conclusions arising from the amount of goodwill and intangibles shown.

Application of Ratios.

To show the application of these ratios, the Balance Sheet of the Mercer Manufacturing Company, shown in Fig. 76, will be used for the purpose of analysis. The annual net sales as shown by the Profit and Loss Statement are $3,390,170 and the annual accounts receivable are $350,190.

1. Current ratio $= \dfrac{\text{Current Assets}}{\text{Current Liabilities}} = \dfrac{\$2,232,010.}{\$841,670} = 2.65 \text{ to } 1.$

According to the 2 to 1 test, the current ratio of 2.65 to 1 indicates a good current position and gives assurance that the firm will be able to meet its obligations.

2. Acid-test ratio $= \dfrac{\text{Current Assets} - \text{Inventories}}{\text{Current Liabilities}} =$

$$\frac{\$2,232,010 - \$880,720}{\$841,670} = \frac{\$1,351,290}{\$841,670} = 1.61$$

As compared to the standard 1 to 1 figure, an acid test ratio of 1.61 to 1 further proves the security of the firms current position.

3. Ratio of Sales to Receivables =

$$\frac{\text{Annual Sales}}{\text{Annual Accounts Receivable}} = \frac{\$3,390,170}{\$350,190} = 9.68 \text{ to } 1.$$

MERCER MANUFACTURING COMPANY
Balance Sheet, Dec. 31, 1928

Assets					Liabilities		
Current Assets:					Current Liabilities:		
Cash			$ 210,870		Accounts Payable	$ 340,180	
U. S. Government Bonds			610,230		Notes Payable	360,230	
Accounts Receivable			350,190		Taxes Accrued	50,640	
Notes Receivable			180,000		Interest Accrued	60,200	
Inventories:					Wages Accrued	15,420	
Raw Materials			$ 200,500		Royalties	15,000	
Goods in Process			240,220				
Finished Goods			440,000				
Total Current Assets			$2,232,010	$2,232,010	Total Current Liabilities	$ 841,670	$ 841,670
	Appraisal Value	Reserve for Depreciation	Book Value				
Fixed Assets:					Fixed Liabilities:		
Land	$ 200,000		$ 200,000		Mortgages on Property	$ 400,000	
Buildings	420,224	$134,000	286,224		Other Bonded Debts	200,000	
Machine and Equipment	680,550	200,000	480,550				
Furniture and Fixtures	40,000	25,000	15,000				
	$1,340,774	$359,000	$ 981,774	$ 981,774	Total Fixed Liabilities	$ 600,000	$ 600,000
Intangible Assets:					Net Worth:		
Patents			$ 290,000		Common Stock	$2,000,000	
Goodwill			700,000		Preferred Stock	500,000	
					Surplus	262,114	
Total Intangible Assets			$ 990,000	$ 990,000	Total Net Worth	$2,762,114	$2,762,114
Total Assets				$4,203,784	Total Liabilities and Net Worth		$4,203,784

FIG. 76.

This figure would indicate payment of accounts on the average of 360/9.68 or 37.2 days. Such a condition is probably excusable in a manufacturing business where collections are usually due in 30 or 60 days. If a 30-day collection policy is in force, however, collections should be speeded up.

Frequently, a firm having a 30-day policy will offer cash discounts for quicker payments. Such a policy will be reflected in the Sales to Receivables ratio by making it considerably larger.

Thus, suppose attractive cash discounts had reduced the Accounts Receivable figure to $201,500. The ratio of Sales to Receivables would be,

$\frac{\$3,390,170}{\$\ 201,500} = 16.8$ to 1 and $\frac{360}{16.8}$ or 21.4 days would indicate the average time for payment of accounts.

When the balance-sheet analyst receives such indications, he is reasonably sure cash discounts for quick payments are being offered.

4. Ratio[1] of Sales to Inventories $= \frac{\text{Annual Sales}}{\text{Annual Inventory}} = \frac{\$3,390,170}{\$880,720} = 3.85$ to 1.

This indicates that the inventory has been turned over, approximately, 3.85 times per year, and that 3.11 months (12/3.85) of inventory is on hand. This may or may not be a good turnover figure and must be checked by current practice within the particular industry. For a machine tool company it would seem all right.

5. Ratio of Cash Position $= \frac{\text{Cash}}{\text{Current Liabilities}} = \frac{\$210,870}{\$841,670} = .25.$

Such a ratio would indicate a satisfactory ratio when checked against the .20 figure. However, general knowledge of the particular business, and common-sense conclusions may lead to higher requirements.

[1] In order to get more exact ratios, annual sales should be at cost figures, and the inventory figure should be the average inventory on hand throughout the year. These figures, however, are hard for credit men to get and, as a substitute, they have used the next best thing obtainable.

6. Various General Conclusions Arising from the Amount of Goodwill and Intangibles Shown.

Total Intangible Assets	$990,000
Surplus	262,114

The large total of intangible assets, $990,000, compared with a surplus of only $262,184 invites immediate suspicion. Have patents and goodwill been written up to avoid showing a deficit? Certainly, great care must be taken in checking up on the methods used in evaluating both patents and goodwill.

Procedure for Analyzing a Single Balance Sheet.

While there has been a great deal written on the subject of balance-sheet analysis probably one of the most useful bits of information is the procedure for analysis as outlined by Gilman, "Analyzing Financial Statements," page 151.

The following is his outline for the analysis of the single balance sheet:

1. Calculate the ratios:
   - *a.* Acid test.
   - *b.* Current ratio.
   - *c.* Ratio of Sales to Receivables (if sales figures are available).
   - *d.* Ratio of Sales to Inventory (if sales figures are available).
2. Check for danger signals:
   - *a.* Disproportionately small amount of cash.
   - *b.* Improper combination of balance-sheet items.
   - *c.* Disproportionately large amount of notes receivable counter to trade custom.
   - *d.* Disproportionately large intangible assets, particularly when there is no surplus.
3. Scrutiny of the balance sheet in order to insure common-sense conclusions.

Analyzing Two or More Balance Sheets of the Same Company.

The reader can well appreciate that the amount of information to be gleaned from one balance sheet is usually insufficient for an intimate knowledge of the business' condition.

The engineer, realizing all engineering measurement is based on comparison, will quickly see that this same principle will apply to the analysis of balance sheets.

If, then, in investigating the Mercer Manufacturing Company's financial status, it be assumed that the statements for both 1927

and 1928 be available, they may be listed in the following statement form:

MERCER MANUFACTURING COMPANY
Comparative Balance Sheet
As of Dec. 31

Assets	1927	1928	Rise	Fall
Cash	$ 180,390	$ 210,870	$ 30,480	$.....
U. S. Government Bonds	620,000	610,230	.....	9,770
Accounts Receivable	375,295	350,190	.....	25,105
Notes Receivable	180,720	180,000	.....	720
Total Quick Assets	$1,356,405	$1,351,290	.....	5,115
Inventories	800,965	880,720	79,755	.....
Total Current Assets	$2,157,370	$2,232,010	74,640	.....
Fixed Assets (book value)	820,560	981,774	161,214	.....
Intangible Assets	960,200	990,000	29,800	.....
Total Assets	$3,938,130	$4,203,784	$265,654	
Liabilities and Net Worth				
Accounts Payable	$ 410,270	$ 340,180	$.....	$70,090
Notes Payable	380,285	360,230	.....	20,055
Taxes Accrued	38,920	50,640	11,720	.....
Interest Accrued	65,200	60,200	.....	5,000
Wages Accrued	16,895	15,420	.....	1,475
Royalties	14,860	15,000	140	.....
Total Current Liabilities	$ 926,430	$ 841,670	.....	84,760
Fixed Liabilities	$ 380,900	$600,000	$219,100	
Common Stock	$2,000,000	$2,000,000	.....	.....
Preferred Stock	500,000	500,000	.....	.....
Surplus	130,800	262,114	131,314	.....
Total Net Worth	$2,630,800	$2,762,114	131,314	
Total Liabilities and Net Worth	$3,938,130	$4,203,784	$265,654	

FIG. 77.

From such statements, the rise and fall of the various items may be easily noted, the ratios computed and compared, and the *trend* of the business for the 2 years noted. While such a method is usually sufficient for credit purposes, is far from satisfying the needs of the industrial engineer and the executive.

The word "trend" gives the clue to further procedure. To get an overall picture of the business *more* Balance Sheets are necessary, and assuming four or more are available, a trend method may be devised which will serve a real purpose for further analysis.

MERCER MANUFACTURING COMPANY
Comparative Balance Sheet
as of Dec. 31.

Assets	1925 Amount	Per cent of 1925	1926 Amount	Per cent of 1925	1927 Amount	Per cent of 1925	1928 Amount	Per cent of 1925
Cash	$ 100,600.00	100	$ 190,820.00	190	$ 180,390.00	180	$ 210,870.00	210
U. S. Government Bonds	750,000.00	...	680,000.00	...	620,000.00	...	610,230.00	...
Accounts Receivable	550,200.00	100	520,630.00	95	375,295.00	68	350,190.00	64
Notes Receivabe	200,320.00	100	190,800.00	95	180,720.00	90	180,000.00	90
Total Quick Assets	$1,601,120.00	100	$1,582,250.00	99	$1,356,405.00	85	$1,351,290.00	84
Inventories	690,475.00	100	710,865.00	103	800,965.00	116	880,720.00	128
Total Current Assets	$2,291,595.00	100	$2,293,115.00	100	$2,157,370.00	94	$2,232,010.00	97
Fixed Assets (Book Value)	650,960.00	100	680,000.00	104	820,560.00	126	981,774.00	151
Intangible Assets	750,000.00	100	819,000.00	109	960,200.00	128	990,000.00	132
Total Assets	$3,692,555.00		$3,792,115.00		$3,938,130.00		$4,203,784.00	
Liabilities and Net Worth								...
Accounts Payable	$ 380,430.00	...	$ 320,960.00	...	$ 410,270.00	...	$ 340,180.00	...
Notes Payable	365,275.00	...	405,300.00	...	380,285.00	...	360,230.00	...
Taxes Accrued	40,268.00	...	37,200.00	...	38,920.00	...	50,640.00	...
Interest Accrued	75,335,00	...	70,000.00	...	65,200.00	...	60,200,00	...
Wages Accrued	22,800.00	...	20,250.00	...	16,895,00	...	15,420.00	...
Royalties	18,475.00	...	16,290.00	...	14,860.00	...	15,000.00	...
Total Current Liabilities	$ 902,583.00	100	$ 870,000.00	96	$ 926,430.00	103	$ 841,670.00	93
Fixed Liabilities	$ 205,682.00	100	$ 280,000.00	136	$ 380,900.00	187	$ 600,000.00	295
Common Stock	$2,000,000.00	...	$2,000,000.00	...	$2,000,000.00	...	$2,000,000.00	...
Preferred Stock	500,000.00	...	500,000.00	...	500,000.00	...	500,000.00	...
Surplus	84,290.00	...	142,115.00	...	130,800.00	...	262,114.00	...
Total Net Worth	$2,584,290.00	100	$2,642,115.00	102	$2,630,800.00	102	$2,762,114.00	107
Total Liabilities and Net Worth	$3,692,555.00		$3,792,115.00		$3,938,130.00		$4,203,784.00	

FIG. 78.

Trend Percentage Method.

Let it be assumed that the four Balance Sheets of the Mercer Manufacturing Company arranged in statement form, as shown in Fig. 78, are available for analysis. If 1925 may be considered a normal year, and, if the trend from that point is desired, the figures of that year may be taken as 100%, and, by dividing through by each major item, the percentage for other years may be determined. Thus, we see a trend in the item of cash of 100%, 190%, 180%, and 210% which tells us immediately that the cash item has steadily increased and that it has been more than doubled during the years, 1925 to 1928.

In a like manner, inventories have increased 100%, 103%, 116%, and 128% during the period under consideration. This is a danger signal, particularly in view of the fact that total quick assets (current assets — inventory) have decreased 100%, 99%, 85%, and 84%.

As a distinct warning to the executive who is afraid of overinvestment in plant, the rise of fixed assets is shown 100%, 104%, 126%, and 151%. As compared with the distinctly slower rise of Net Worth 100%, 102%, 102%, and 107%. This is a dangerous condition. Intangibles, ever a source of suspicion, are rising 100%, 109%, 128%, and 132%.

Current liabilities are shown holding their own, but the rise in fixed liabilities, 100%, 136%, 187%, and 295%, shows that the company has been leaning quite heavily toward long-term financing, which is apt to be dangerous in a manufacturing business. (In a public utility where income is assured, long-term financing is considered good business.)

This method, called the trend percentage method, by Gilman, gives a very clear indication towards such common business ills such as overinvestment in inventory, overinvestment in receivables, overinvestment in plant, insufficient net worth, etc.

The reader is no doubt wondering why ratios are not mentioned. To be sure a *ratio trend* method may be used but from all angles the percentage method is simpler, easier to explain, and tells a clearer story.

Procedure for Analyzing Two or More Balance Sheets of the Same Company.

Again, a definite procedure is advised and the best of these is found in Gilman's "Analyzing Financial Statements," page 151. It is shown in the following table:

1. Calculate the trend percentages for:
   a. Receivables.
   b. Quick assets.
   c. Inventories.
   d. Current assets.
   e. Fixed assets.
   f. Current liabilities.
   g. Long-time liabilities.
   h. Total liabilities.
   i. Net worth (or capital stock and surplus separately).
2. Study the trend percentages for trends toward:
   a. Overinvestment in receivables.
   b. Overinvestment in inventory.
   c. Overinvestment in fixed assets.
   d. Insufficient capitalization.
3. For the latest balance sheet of the series:
   a. Calculate the "acid test" ratio.
   b. Calculate the current ratio.
   c. Check for the four danger signals.
   d. Determine whether unfavorable trends have reached a danger point.
4. Scrutinize the balance sheets in order to insure common-sense conclusions.

Standard Ratios.

Ratios, as used on pages 387, 388, and 390 of this chapter, were those applying to the same company. The question naturally arises in such a ratio as the current ratio, is the 2 to 1 thumb rule good enough? In certain types of businesses a 2 to 1 ratio may be fine, but what condition should be expected in a business requiring a large amount of quick assets, as for example, a 5- and 10-cent store or some other business which needs large amounts of cash to take advantage of ever occuring purchasing opportunities. In such businesses it is not uncommon to find a current ratio of 10 to 1 or 15 to 1.

Attempts have been made to compile various standard ratios for different types of businesses, the most notable being that of James H. Bliss, Comptroller of Libby, McNeill, and Libby in his works entitled, "Financial and Operating Ratios in Management," and "Management through Accounts."

The following examples give an idea of the scope of this study.

THE WORKING CAPITAL RATIO, STATED IN DOLLARS OF CURRENT ASSETS PER $1 OF CURRENT LIABILITIES
(Based on Published Reports of Representative Companies.)

Companies	1913	1914	1915	1916	1917	1918	1919	1920	1921	Average for entire period years
Automobile and Truck Manufacturers:										
Packard Motor Car Co	$ 7.93	$ 9.52	$ 4.59	$ 4.07	$2.84	$2.62	$3.52	$4.04	$5.73	$3.61
Reo Motor Car Co	14.18	7.81	6.94	6.40	3.11	3.12	4.41	2.89	6.11	3.95
General Motor Corp	4.33	5.65	11.50	5.24	3.54	3.09	2.13	2.15	2.17	2.52
Studebaker Corp	.....	5.52	5.64	3.34	3.14	2.60	4.86	2.50	3.76	3.38
Hendee Manufacturing Co	.....	24.42	8.95	10.10	4.19	4.02	4.52	4.49	8.11	5.24
Willys-Overland Co	.....	1.82	1.67	2.69	1.92	1.65	1.36	1.68	1.22	1.70
Chandler Motor Car Co	.....	.....	4.88	3.06	4.02	2.16	2.36	2.11	1.47	2.37
White Motor Co	.....	.....	5.24	6.66	4.31	2.79	4.90	2.91	3.44	3.72
Ford Motor Co	6.39	6.44	6.41	6.33	4.29	8.19	2.25	2.83	1.49	2.89
Averages, 9 companies, 7 years	.....	.....	$ 4.60	$ 4.33	$3.19	$3.22	$2.30	$2.41	$2.02	$2.67

	Number of years in period	Number of companies in group	Number of day's sales in accounts
Auto and Truck Manufacturers	6	5	35
Auto Accessory Manufacturers	5	6	31
Chemical Products Manufacturers	6	4	81
Coal, Bituminous	7	4	88
Copper Mining and Manufacturers	9	11	21
Cotton Goods Manufacturers	7	4	79
Drug Manufacturers and Distributors	6	2	34
Electrical Machinery Manufacturers	8	3	85
Explosives Manufacturers	9	2	55
General Merchandising	7	3	17
Iron and Steel Manufacturers	8	6	39
Lead Production and Manufacturers	7	2	50
Leather Manufacturers	9	2	46
Mail-order Merchandising	9	2	32
Petroleum Oil Companies	7	6	50
Paper Manufacturer	5	2	42
Railway Equipment Manufacturers	8	4	70
Retail Chain Stores	6	5	3
Rubber and Tire Manufacturers	9	4	61
Slaughtering and Meat Packing	9	4	41
Sugar Producing and Refining	8	4	23
Tobacco Products	9	2	33
Averages:			
87 Companies, 1916 to 1921	6	87	44
53 Companies, 1914 to 1921	8	53	45

	Number of years in period	Number of companies in group	Dollars of sales per $1 of inventory
Auto and Truck Manufacturers	6	5	3.17
Auto Accessory Manufacturers	5	6	4.25
Chemical Products Manufacturers	6	4	5.42
Coal, Anthracite	8	2	14.22
Coal, Bituminous	7	4	8.93
Copper Mining and Manufacturers	9	12	3.91
Cotton Goods Manufacturers	7	4	3.42
Drug Manufacturers and Distributors	6	2	3.78
Electrical Machinery Manufacturers	8	3	2.67
Explosives Manufacturers	9	2	4.02
General Merchandising	7	3	5.42
Iron and Steel Manufacturers	8	6	5.02
Lead Production and Manufacturers	7	2	2.21
Leather Manufacturers	9	2	1.55
Machinery Manufacturers	6	4	2.16
Mail-order Merchandising	9	2	4.03
Petroleum Oil Companies	7	6	2.35
Paper Manufacturing	5	2	3.83
Railway Equipment Manufacturers	8	4	4.58
Retail Chain Stores	6	5	5.93
Rubber and Tire Manufacturers	9	4	2.79
Slaughtering and Meat Packing	9	4	7.48
Sugar Producing and Refining	8	4	3.73
Tobacco Products	9	2	1.77
Averages:			
94 Companies, 1916–1921	6	94	4.21
45 Companies, 1914–1921	8	56	4.45

Let it be assumed then that an executive, engineer or accountant finds the current ratio of an automobile manufacturing firm he is investigating to be 3.25. The Bliss tables show that 2.67 is an average ratio for this industry and hence 3.25 may be considered a good current ratio.

While the idea behind such practice is excellent, the difficulty of gathering considerable data on the same industries under similar conditions of operation is indeed a well nigh impossible task. Such factors as size, location, marketing methods, manufacturing policies, etc. are so variable even with the same industry as to make the finding of like conditions almost an impossibility. Herein then lie the difficulties of standard ratio.

Ideal Ratios.

Gilman suggests building up a series of ideal ratios based on a scientific study of the variable factors mentioned previously. This would require an intensive research and to the author's knowledge no such attempt has been made at the present time (1930).

Profit and Loss Statement Analysis.

While a great deal has been written upon Balance-Sheet analysis, comparatively little has been published regarding Income and Expense statement or Profit and Loss Statement analysis.

The reason seems obvious. Credit men were able to obtain Balance Sheets and their work was started and given impetus years before it was possible to obtain good profit and loss figures.

Today, however, better statements are available and executives who have complete access to the company's figures have turned to statement analysis. Hence, the great need for information on the Profit and Loss Statement analysis.

MERCER MANUFACTURING COMPANY

Statement of Income and Expense for the year ending Dec. 31, 1928

			Per-centage
Gross Sales		$3,564,850	
Deductions from Sales:			
Sales Returned	$ 24,460		
Sales Allowances	5,540		
Outward Freight	144,680		
	$174,680	174,680	
Net Sales		$3,390,170	100.00
Manufacturing Cost of Goods Sold (see schedule)		2,841,910	83.82
Gross Profit on Sales		$ 548,260	16.18
Operating Expenses:			
Purchasing Expenses	$ 20,460		
Selling Expenses	60,270		
Controllers Expenses	25,430		
General Office Expense	14,680		
Miscellaneous Expenses	17,890		
	$138,730	$ 138,730	4.08
Net Profit		$ 409,530	12.10

FIG. 79.

In the above illustration (Fig. 79) is presented the Income and Expense statement of the Mercer Manufacturing Company

for 1928. The general expressions covering such a statement are

1. Net Sales — Manufacturing Cost of Sales = Gross Profit.
2. Gross Profit — Operating Expense = Net Profit.

An adequate net profit is the aim of all business. Just what is a fair or an adequate profit is a matter of much controversy. Certainly, it should be higher than the average interest rate on high-grade securities for, if a business yields no higher return, its owners had better safely invest their money in securities and avoid the rigors of competitive business.

While no real guide may be given as to what is a good return, current opinion among business men would place the figure somewhere between 10 to 15% of net sales.

In order to make a suitable profit, the factors in expressions (1) and (2) must bear the proper relationship to one another. If an inadequate profit (say, 5%) or a loss is incurred, certain factors in the expression are out of proportion.

For example, a loss or inadequate profit may be due to *not selling a sufficient amount, the manufacturing cost of sales being too high,* or the *operating expenses being too great.*

Such facts have led to the relatively simple analysis method of listing in a separate column the percentage on net sales as shown in the foregoing Income and Expense Statement. It will be noted that the Manufacturing Cost of Goods Solds is 83.82% of net sales, the operating expense, 4.08%, and the net profit, 12.10%. For a manufacturing business in the absence of unusual risks such a net profit may be considered satisfactory.

As in the case of balance-sheet analysis, a single statement is insufficient and conclusions drawn therefrom are apt to be misleading. Therefore, it becomes feasible and desirable to acquire the statements for 3 or 4 years and to apply the *trend* percentage method.

Trend Percentage Method Applied to Income and Expense Statements.

For the purpose of trend percentage analysis, the Income and Expense statements of the Mercer Manufacturing Company may be tabulated in the condensed form shown in Fig. 80, illustration *A*. Percentages are calculated as explained in balance-sheet analysis.

The trend percentages give us the following information at a glance.

MERCER MANUFACTURING COMPANY
Comparative Income and Expense Statements for years ending Dec. 31,
Illustration *A*

	1925 Amount	Per cent of 1925	1926 Amount	Per cent of 1925	1927 Amount	Per cent of 1925	1928 Amount	Per cent of 1925
Net Sales	$2,613,879	100	$2,818,972	108	$3,270,265	125	$3,390,170	130
Manufacturing Cost of Goods Sold	1,920,727	100	2,225,729	116	2,585,295	135	2,841,910	148
Gross Profit	$ 693,152	100	$ 593,242	85	$ 684,970	99	$ 548,260	79
Operating Expense	95,520	100	97,273	102	130,643	137	138,730	145
Net Profit or Loss	$ 597,632	100	$ 495,970	83	$ 554,327	93	$ 409,530	68

MERCER MANUFACTURING COMPANY
Comparative Statements of Manufacturing Cost of Goods Sold
Illustration *B*

Materials Used	$ 752,384	100	$1,034,281	138	$1,325,219	176	$1,423,985	190
Direct Labor	832,727	100	927,856	111	1,075,102	129	1,125,311	135
Factory Expense Distributed	232,991	100	348,927	149	423,204	182	528,788	226
Total	$1,818,102		$2,311,064		$2,823,525		$3,078,084	
Add or deduct decrease or increase in Work in Process Inventory	[1]325,912		[1]210,186		[2]432,807		[2]424,090	
Cost of Finished Goods Completed	2,144,014		2,521,250		2,390,718		2,653,994	
Add or deduct decrease or increase in Finished Goods Inventory	[2]223,287		[2]295,521		[1]194,577		[1]187,916	
Manufacturing Cost of Goods Sold	$1,920,727		$2,225,729		$2,585,295		$2,841,910	

[1] Add because of a decrease in Inventory. [2] Subtract because of an increase in Inventory.

FIG. 80.

	Percentages
1. Net Sales have been increasing	100; 108; 125; 130
2. Manufacturing Cost of Sales have been increasing faster	100; 116; 135; 148
3. Gross Profits have fallen off with a recovery during 1927	100; 85; 99; 79
4. Operating Expenses have been increasing faster than Net Sales and almost as fast as Manufacturing Cost of Goods Sold	100; 102; 137; 145
5. Net Profits have fallen off with a recovery in 1927	100; 83; 93; 68

The difficulty is evidently to be found and remedied in the Manufacturing Cost of Sales items and the Operating Expense items.

Such a clear, concise, and simple method gives the executive clear knowledge of dangerous factors. If he desires more detailed information, he must apply the same principles to the various schedules that supplement the Income and Expense Statement.

Let him look into the details of Manufacturing Cost of Goods Sold, General and Administrative Expense (Operating Expense), etc. and in such a manner he will be able to control the fluctuation of the items that are causing the falling off in net profit.

In the example given of the Mercer Manufacturing Company, the cause of the falling off in Net Profits may be clearly shown by applying the percentage trend method to the Manufacturing Cost of Goods Sold Statement. Referring to page 401, illustration *B*, it is seen at a glance that materials used and factory expense have been increasing at an alarming rate for the years 1925 to 1928, inclusive.

	Percentages
Materials used	100; 138; 176; 190
Factory expense	100; 149; 182; 226

This trend may indicate for materials used such inefficiencies as unwise purchasing, inadequate planning, poor stores-keeping, large amounts of waste materials.

In the case of factory expense, the indirect labor item would first come under suspicion. Possibly too many "red-tape" methods are being used, and, as a result, there are one or more clerical positions being created for every one of direct labor. Items such as oil, waste, grease, and other maintenance factors may be accounted for in a loose manner. Supervision may be poorly utilized because of the lack of a proper organization chart.

These and many other questions are directly brought to the mind of the managing executive as the result of statement analysis. If he is wise, he will ask for a further breakdown of these figures and in such a manner exercise complete control.

Procedure for Analyzing a Series of Profit and Loss Statements. Gilman gives the following valuable procedure on page 182 of "Analyzing Financial Statements."

1. Determine the percentage of net profit for each year to the net worth at the beginning of the year, or to the average net worth during the year.
2. Study the operating expense trends in as much detail as possible in relation to sales trades, and roughly chart the trend percentages to obtain graphic comparison of slopes.
3. Study the operating ratios for all statements.
4. Observe the operating ratio and the ratio of operating expenses to net sales and the ratio of net profit to net sales for the most recent statement of the series.
5. General scrutiny of statements prior to forming conclusions in order to insure common-sense viewpoint.

For a series of manufacturing statements about the same procedure should be followed except that the trend study should be extended to include the labor, material, and manufacturing expense elements of the cost of goods sold

SUMMARY

In Chap. XIX, the following points were emphasized:

1. Statement analysis had its origin with the credit man whose work gave rise to empirical ratios.
2. Analyzing two or more Balance Sheets enables the analyst to judge trend.
3. The trend-percentage method is an excellent scheme for quickly judging trend.
4. Standard ratios are excellent, if sufficient data under similar conditions is obtainable.
5. Profit and Loss analysis may be accomplished by the trend-percentage method.
6. Definite analysis schedules are very helpful and should be used as a guide in analyzing statements.

CHAPTER XX

CONTROVERSIAL AND DEBATABLE ACCOUNTING SUBJECTS

OBJECT OF CHAPTER: To present certain controversial and debatable accounting points as: Inclusion of interest as a "cost," purchase discounts, sales discounts, determination of normal distribution rates, and replacement value in determining depreciation.

Interest on Investment a Debated Point.

Interest on investment is a much debated point of accounting and hinges upon two radically different points of view. Those who favor the inclusion of interest believe that interest is a *cost* and should be charged into the cost of manufacture in the same manner as labor, material, and expense. This is the economic conception of the problem. Accountants who oppose the inclusion of interest claim that interest is a part of profit or an attribute of capital and, hence, has no place in manufacturing costs.

While it is not likely that these two radically opposing points of view will be reconciled in the near future, it can be stated that a large number of industrial engineers and trade organizations, without number, definitely include *interest as a cost* in their plans for uniform accounting.

Reasons for the Inclusion of Interest as a "Cost."

From a managerial point of view, interest as a cost has many advantages. For example, if a manufacturer is about to purchase a Bullard Mult-Au-Matic at a cost of $20,000 to replace several smaller machines costing, say, $10,000, in order to get a true comparison of costs under the two methods of operation, interest on the investment must be included.

Material Handling Formulæ of A. S. M. E.

The formulæ of the Materials Handling Division of the American Society of Mechanical Engineers definitely recognize

that the inclusion of interest is necessary in their calculations as the following extract of their work will show:

Debit Items:

A = percentage allowance on investment (interest).
B = percentage allowance to provide for insurance, taxes, etc.
C = percentage allowance to provide for upkeep.
D = percentage allowance to provide for depreciation and obsolescence.
E = yearly cost of power, supplies, and other items which are consumed, total in dollars

Credit Items:

S = yearly saving in direct cost of labor, in dollars.
T = yearly saving in fixed charges, operating charges, or burden, in dollars.
U = yearly saving or earning through increased production, in dollars.
X = percentage of year during which equipment will be employed.
I = initial cost of mechanical equipment.

Results:

Z = maximum investment in dollars justified by the above consideration.
Y = yearly cost to maintain mechanical equipment ready for operation.
V = yearly profit from operation of mechanical equipment.

Then:

$$Z = \frac{(S + T + U - E)}{A + B + C + D} X. \qquad (1)$$

$$Y = I\,(A + B + C + D). \qquad (2)$$

$$V = [(S + T + U - E)X] - Y. \qquad (3)$$

Applications of the Formulæ.

As an example of an application of the formulæ, assume that the handling of miscellaneous materials about a factory which has formerly been done by four men, receiving $3.50 per day each, or, allowing 300 days per year, at an annual direct cost of $4,200, can be done by one man operating an electric storage-battery industrial truck at a direct-labor cost of $1,050 per year, thus effecting a saving at the rate of $3,150 per year in direct-labor cost.

Assume, also, that through the greater promptness in moving materials and the more continuous operation of machines, there is an increase in earnings, due to increased production, valued at $650 per year; also, that the labor involved, being accounted as "non-productive," carries a fixed charge or burden of 10%. In actual practice, the plant operates 240 days per year or 80%

of the time. The various factors, therefore, are estimated as follows:

$$\begin{aligned} A &= 6\% & S &= \$3{,}150 \\ B &= 4\% & T &= 315 \\ C &= 20\% & U &= 650 \\ D &= 25\% & X &= 80\% \\ E &= \$450 \end{aligned}$$

$$Z = \frac{(\$3{,}150 + \$315 + \$650 - \$450) \times .80}{.55} = \$5{,}331.$$

This indicates that equipment costing any sum below $5,331 will earn some profit above interest on investment and maintenance.

Assume that an electric storage-battery industrial truck will meet the conditions stated and that its cost will be $2,200. Then the yearly cost to maintain equipment ready for operation, exclusive of labor, will be expressed by the formula,

$$Y = I(A + B + C + D) \text{ or } \$2{,}200 \times .55 = \$1{,}210.$$

Then the profit from operation of the mechanical equipment, according to (3), becomes

$$[(\$3{,}150 + \$315 + \$650 - \$450) \times .80] - \$1{,}210 = \$1{,}722.$$

The profit V, or $1,722, represents an annual earning upon the initial investment, over all items of cost, of over 78%.[1] Many other similar examples may be given.

Pros and Cons of Interest Inclusions.

Lawrence, "Cost Accounting," pages 314 to 315, summarizes the pros and cons of interest inclusion very ably in the following resumes:

Reasons for Inclusion of Interest in Cost.

Among the principal reasons given in favor of the inclusion of interest in cost are:

1. Accounting should follow the economic concept of cost.
2. Interest permits measuring the relative economy of methods or machines.
3. To prove the correctness of preliminary estimates.
4. To distinguish between kinds of business or lines of sales in determining the profitableness of each.

[1] From *Mechanical Engineering*, September, 1923, p. 564.

5. To show for different departments the cost which arises from the use of capital.

6. To account properly for the time element in cost.

7. To determine the cost of capital in relation to large or small inventories.

8. To show when it is cheaper to buy or to manufacture parts of the factory product.

9. To compare the cost of owned with rented or leased plants.

10. To weigh different methods of financing.

11. To secure uniform cost methods in trade associations.

12. As an inducement to increased production.

Reasons for Noninclusion of Interest in Cost.

Among the principal reasons given in opposition to the inclusion of interest in cost are:

1. Accounting cost need not be reconciled with economic cost.

2. Interest on investment does not represent an actual outgo and, therefore, is not a cost.

3. Inclusion of interest on investment in cost inflates inventories and anticipates profit.

4. Interest is not necessary for the comparison of different methods.

5. If it is desirable to know the amount of interest in cost it can be secured without putting it in the accounts.

6. It is impracticable to determine on what the interest should be computed or what rate of interest should be used.

7. Interest may cause a profit to be shown when no sales have been made.

8. Inclusion of interest in cost tends unduly to increase prices.

9. Interest is not a deciding, or even an important, factor in making cost comparisons.

Objections and Answers Concerning Interest Inclusion.

Scovel, "Interest as a Cost," pages 222–234, presents a fine piece of real research work on the subject and answers many current accounting objections in the following objection and answer method.

1

Objection.

A credit to the account known as "interest-charged-to cost" is fictitious, for it does not represent anything actually received.

Answer.

Such a credit is no more fictitious than the credit in the case of any nominal accrual (like depreciation). Modern accounting often esti-

mates influences on business progress before they definitely materialize in dollars and cents. Just as a depreciation charge is a working estimate of impairment that must later be made up through an actual outlay of cash, so interest on investment is a working estimate of a cost which ultimately should be returned through income.

2

Objection.

The inclusion of interest leads to an "anticipation of profit."

Answer.

This argument really begs the question, because it takes for granted that "interest" is profit. Obviously, if interest on investment is profit, it is not cost. Such an assumption, however, is contrary to standard economic theory. Interest on investment is a cost; and wherever it appears, it is a cost that appears and not a profit.

Likewise an objection to the inclusion of interest because the inventories then contain an "anticipation" of the return for the use of capital, has no weight. It is no more improper to "anticipate" the return for the use of capital than it is to "anticipate" the reimbursement for asset deterioration (depreciation), material outlay, or labor outlay. Since interest is a cost, why should not the manufacturer expect to get it?

3

Objection.

The inclusion of interest leads to an "inflation" of inventories.

Answer.

It is a curious commentary upon the workings of the human mind that some who object to interest on the ground of inflation of inventories, are the very ones who overlook cases of real inventory inflation. Some interest opponents of high standing, for example, have passed with approval inventories in which goods were taken higher than in the preceding annual inventory, because, forsooth, with a curtailed volume they "cost more to make" during the later year than during the earlier. Here the expense of unearned burden, which is not in any proper sense cost-to-manufacture, was unhesitatingly added to inventory values "at cost." Errors of this sort, committed in good faith but in blissful ignorance of realities, would probably far outweigh any so-called "inflation from interest inclusion," even if this were possible.

As a matter of fact, however, the use of the word "inflation" in connection with interest inclusion again begs the question. There can be no inflation resulting from including any element which is a cost. Since interest on investment has been shown to be a cost, it logically and

properly raises the value of manufactured goods as much as any other cost.

Any inventory of manufactured goods has used capital, frequently in huge quantities, in the process of conversion from raw material to finished product. It has also used capital in the possession of the producer before coming to the manufacturer, and the purchase price to him is higher accordingly. If it has used capital, it has, indisputably, a greater cost. If the manufacturing business has been sensibly managed, the product is worth what it has cost in capital in its last stage (manufacturing), just as much as in any previous (producing) stage. To be specific, the capital cost of converting seasoned lumber into furniture is just as inevitably an addition to its cost, and just as fair an addition to its inventory price as the cost of seasoning it beforehand.

In short, it takes capital to manufacture, more or less capital according to the kind of product made, and according to the manufacturing policy pursued. Frequently, a liberal use of capital diminishes other costs, and the too meager use of capital increases other costs.

Interest on investment is the conventional and logical way of expressing capital cost. Since one accepts an arbitrary charge for depreciation as a good asset in the cost of manufactured goods, the logic seems unavoidable that there should be no greater objection to a charge for interest. *One kind of cost is as good an addition as another.*

The fact that interest in an inventory is not "realized" is immaterial. The labor cost embodied in the inventory is not realized until the goods are sold, but no one will deny that labor is a cost. The fact is that interest, like labor, is a cost whether it is realized or not. Profit is the only factor of selling price that is determined by sale and the profit may prove to be a minus quantity, even without any debatable cost.

Let no one infer from these remarks that it is not important to be conservative in valuing an inventory. All accountants should strive zealously to see that items or values which do not belong in the inventory are rigidly excluded. There may be many considerations to influence the adoption of a pricing below cost on inventory items, or a liberal reserve against the total, or important sections, of the inventory. If there are good reasons for such action in a given case, they should be heeded; but if cost is the basis of the inventory valuation, then by all means every cost should be included.

As far as the "inflation" fallacy is concerned, therefore, no reason exists why an inventory should not be carried at *all its cost*, including as much as is due for interest on investment. This is the theoretically correct practice. If bankers' demands or tax requirements in a particular case require an adjustment of inventories on the financial statements, through the elimination of the total interest in the manner described the change does not invalidate the interest-as-a-cost theory. Cost is cost, and no concession makes it otherwise. Hence, an elimination of

interest from the inventories in such a case cannot justly be regarded as a matter of correcting an error in accounting principle.

4

Objection.

Bankers insist upon scaling down inventories to exclude interest.

Answer.

One must admit this practice on the part of some bankers. The Federal Reserve Board, for example, has taken the position—in a tentative proposal submitted to the public in regard to the preparation of balance-sheet statements (but evidently inspired by accountants who knew little about costs)—that no interest should be included in manufacturing cost and in inventories. Not all bankers, however, are hostile to the idea of interest in inventories. Most of the bankers with whom the Bureau of Business Research of Harvard University has conferred in its retail investigations, state that they have no serious objection to the inclusion of interest in "expense" (the trading concept corresponding to the "cost" of the manufacturer), provided the enterprise always follows the same method.

Even were all bankers opposed to the practice, one would have to deny that their opinion should have preponderating weight on the general subject of including interest in cost. Bankers may insist upon underrating Accounts Receivable or upon performing other acts of conservatism, but this fact should not influence the accounting. It should influence merely the adjustments that the owners may think it necessary or desirable to make in the statements prepared from the books of account. On the point of interest, an adjustment for the banker can be made by eliminating from the inventory the accumulated interest. It is better to do this than to leave an essential and calculable element out of cost.

Some accountants have argued that it is "practically impossible" to eliminate interest from the cost of the finished product, because "the identity of the interest charges has been lost in the distribution of the overhead." But these accountants cannot see the woods because they are looking at a tree. They are talking about the *interest element* in the cost of some *unit* of product, whereas the only interest figure required in the adjustment of a financial statement is the *aggregate interest* contained in the *inventory total* for all units, of whatever kind.

When part of an inventory contains interest and part does not, or when the inventory is made up of different types of articles with varying interest components in their costs, it may not be possible to determine with exactness the one interest figure to be deducted from the inventory total. But to waste time deploring one's inability to pick out every penny of interest would be an unjustifiable procedure,

since there can be no absolute accuracy in the valuation of an inventory. Reasonable accuracy is the criterion followed in marking an inventory down from cost to market, and the same is permissible in eliminating interest from the inventory. Even in the most difficult case of inventory adjustment for interest, it is sufficient to make an approximate determination of the total interest charge, in accordance with the procedure previously described for either the interest-charged-to-cost method or the interest-reserve method. The deduction of this amount from the inventory accomplishes every purpose of those who insist upon the exclusion of interest from the balance sheet for banking purposes.

5

Objection.

Income tax regulations do not allow interest on investment to be included in inventory cost.

Answer.

It is true that the Treasury Department has refused to recognize interest on investment as a proper element of inventory cost. Although in its definition of "cost," it allows indirect expenses incident to and necessary for production (including a reasonable proportion of management expenses), it specifically excluded "any cost of selling or return on capital, whether by way of interest or profits." Still, is not this differentiation between "interest" and "profits" noteworthy? Even if interest on investment is not allowed as a cost, it apparently is not unobserved that interest as a return on capital (*i.e.*, for use) is distinct from profit as a return on capital (*i.e.*, for risk).

As a matter of fact, the Treasury Department is not quite so indifferent to interest as it might be, for "under certain circumstances" interest "actually paid or to be paid" may be included in cost. Thus, in the case of liquor in bond, interest is a proper allowance if it is for "money actually borrowed for the purpose of carrying the liquor." But here, of course, is an adherence to the fallacy which even interest opponents have disowned—namely, that a dollar borrowed should be treated differently in cost accounting from a dollar owned. Here, too, is a queer persistence of the old cash-basis idea; in the light of present-day accrual accounting, and in view of the Treasury Department approval of such a non-cash item as a depreciation allowance, the exclusion of interest on *owned* capital on the ground that it is not "actually paid out," is wholly arbitrary.

But it does no good to kick against the pricks. If, as so often seems to be the case, the Treasury Department is prompted by revenue needs to strain an accounting principle, the proper procedure for the manufacturer is not to abandon the principle, but to follow it in his own

accounting and make such an adjustment as may be required for his tax reports.

This is exactly what he should do in his interest accounting. The theoretical propriety of interest as a cost is so clear, and its practical benefits are so sure, that the manufacturer should allow no artificial tax barrier to prevent its current use. If he has to eliminate interest from his costs for what is relatively a mere side issue, he can do so with despatch and reasonable precision, in his regular accounting, however, he should stick to sound theory and useful practice.

6

Objection.

As between two different kinds of machines used to produce the same product, but having different investment values, the conclusion reached by comparing the costs including interest at 5% will be different from that reached by including interest at 7%.

Answer.

Naturally. So would the costs be different if a shorter period of useful life, and therefore greater depreciation, were assumed for the machines. If the machines were written off over, say, 10 years instead of 15, the costs would be higher because of the increased allowance for depreciation. This quite obvious fact, however, does not lead men to argue that depreciation be omitted from cost. They just set to work, make a reasonable estimate of the life of the machines, embody the resulting depreciation allowances in cost, and rest content that they have recognized a necessary factor of cost in a reasonable manner. They are not warranted in following any different course in the case of interest.

The fact is that the rate of every factor of cost is a matter for *decision*. Even in the cases of materials and labor, the management may use a more or less expensive type. The only difference between determining the rates for depreciation and interest and the rates for materials and labor is that, in the latter cases, one must consider the demands of the vendors and of labor. But, at the time of the 1922 coal strike, Henry Ford refused to pay a certain rate for coal because he did not consider it fair or reasonable. Other manufacturers have refused to pay certain wage rates for the same reason. When a manufacturer pays or uses a rate, be it for interest, depreciation, materials, or labor, it is because he *decides* to do so; and certainly his actual cost is no less or no greater because he might have decided differently.

7

Objection.

Depreciation, taxes, and insurance are pro rated according to the relative values of property and equipment utilized in production; hence

distinctions of varying investments are fully covered without accounting in cost for interest, which would merely increase the amount of overhead chargeable to production, and would not affect the ratios between costs of different departments, processes, or lines.

Answer.

The first weak point in this objection is the fact that the "mere" increase in the overhead *is* essential to a determination of the true cost. In view of what has been said elsewhere about the importance of accounting for every cost, it will suffice to pass over this point after this indication of notice.

The second weak point is that the omission of one overhead element *does* have a bearing upon cost ratios between departments, processes, or lines. If cost included only items pro rated according to investment, then the exclusion of interest would not alter the ratios. In as much, however, as cost includes material and labor charges, and overhead or burden items pro rated on bases other than investment, the omission of interest is practically certain to affect the ratios.

A simple example —hypothetical but sufficient to indicate the fallacious reasoning underlying this objection—will make this point clear. Suppose that two articles show exactly the same cost for material, labor, and all overhead except insurance, taxes, depreciation, and interest, the ratio therefore being 1:1. Now, suppose that the investments concerned are half as much for the first article as for the second, and—to make the calculation simple—that the cost increments for the four items (insurance, taxes, depreciation, and interest) are figured on the same basis, are equal, and therefore run .1 and .2 each for the respective articles. After the addition of the insurance increment, the ratio stands 1.1 : 1.2, or 91%; after taxes, 1.2 : 1.4, or 85%; after depreciation, 1.3 : 1.6, or 81%; and after interest, 1.4 : 1.8, or 77%. Thus, with each increment of overhead due to the disparity in investments, the cost of the first article shows a smaller percentage relationship to that of the second. (Were the increments numerous enough, the percentage would drop to 50 in infinity.)

Admittedly, in actual production, the problem of determining the detailed ratios would be very complex; but to see the fallacy under discussion it is not necessary to know them exactly. The vital point is that, in so far as any costs for material, labor, or non-investment overhead, for two departments, processes, or lines, show a different ratio from that prevailing between the investments concerned—and there are bound to be differences—then the addition of every single overhead item based on investment does affect the ratio between the total costs.

Interest, therefore, should be included in cost not only because it gives the true cost for an individual article or process, but also because

it is necessary to effect accurate comparisons between the costs of different articles or processes.

8

Objection.

The objects sought in including interest in cost can be secured equally well by recording interest calculations outside the books of account.

Answer.

This is not unlike the out-of-date argument which would have kept accounts on an actual receipt and disbursement basis and reckoned accruals as statistical information "on the side." What is more important, however—the need for interest on investment in cost frequently arises under conditions which would make a detached calculation utterly impracticable, both because of the clerical difficulty and because of the impossibility of properly visualizing the relationship between the detached calculation and the cost records in which other fixed charges (taxes, insurance, and depreciation) are necessarily embodied.

It may well be that the accomplished comptroller of some huge industrial corporation is in the habit of making precise calculations involving the exact use of economic theories, entirely apart from straight-forward, double-entry bookkeeping, and that these calculations can be practically applied and made to serve every need for information which arises in this connection. Anyone with a fairly broad experience with constructive accounting in a wide variety of industries, however, is justified in doubting whether an attempt of this kind could be expected to succeed with the ordinary manufacturer or his overworked chief accountant. In such a case, the only safe procedure is to see that the facts regarding interest as a cost are embodied in the accounts so that they cannot be forgotten.

The manufacturer himself may not be actively interested in the mechanism, or the accounting practice or procedure, by which cost is determined, but the accountants who are responsible for the design, the installation, and the successful operation of systems calculated to produce this information, have long since learned to avoid the snares and pitfalls of supplementary and detached records, and to tie the whole chain of information solidly into the general accounting.

Thus it will be seen that interest on investment is a much debated question. From a managerial and industrial engineering and economic viewpoint, however, the inclusion of interest has so many advantages that it is the author's belief that there is a definite trend towards its inclusion in costs.

Handling Purchases Discounts.

The treatment of purchase discounts hinges upon two points of view.

1. Shall purchase discounts be treated as a reduction of the cost of goods purchased?

2. Shall purchase discounts be treated as an item of financial income?

Point 1 is based on the theory that the manufacturing departments are entitled to all savings that result from the financial and administrative functions.

Point 2 contends that manufacturing is a distinct function apart from the financial and administrative functions and hence should not be penalized or rewarded for losses or gains resulting from such efforts.

Handling Sales Discounts.

The same points come up in this discussion.

1. Shall sales discounts be treated as a reduction in the selling price?

2. Shall sales discounts be treated as an item of financial outgo?

Sales discounts may be given to obtain the prompt paying of accounts receivable or they may be be given because of trade custom or competition conditions. In the first case, such discounts would be a financial expense while, in the second case, they would act as a reduction in the selling price.

Because of the great increase in competitive conditions, the trend among executives is to give the manufacturing departments the benefits of all savings and to treat sales discounts as a reduction in the selling price. It is however, strongly recommended that, whatever point of view is taken, the same procedure be followed for both purchases and sales discounts in order to obtain a Profit and Loss Statement that will tell a true story.

Determination of Normal Distribution Rates (See Chap. XIV).

The points involved in this discussion are

1. Shall the normal point be based on 100% of manufacturing capacity?

2. Shall the normal point be based on 80% of manufacturing capacity?

3. Shall the normal point be based on an average of a number of years of past experience and future estimates?

Point 1 is based on the contention that the buyer should not be charged with idle plant capacity due to the inability of the management to schedule work to all the machines throughout the day.

Point 2 allows for flexibility in scheduling and is based on the contention that the customer should pay for the unused plant capacity.

Point 3 is based on a long look forward and backward and arrives at a normal, based on such averages as shown diagrammatically below:

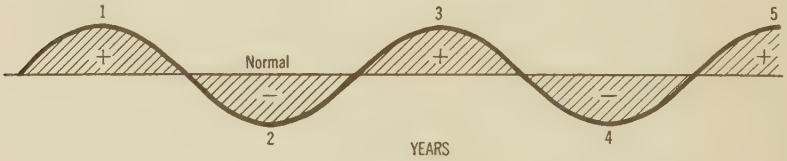


FIG. 81.

The executives of most plants favor points 2 and 3 in view of the fact that manufacturing, administrative, and selling conditions make it well nigh impossible to keep a plant running at 100% capacity.

Replacement Value in Determining Depreciation.

During certain periods when the rising cost of replacements is great, due to the decline in the purchase value of the dollar, many executives and even certain classes of accountants contend that depreciation should be based on *replacement value* rather than *original value*. Under such accounting they would debit Depreciation and offset it either by a straight credit to Reserve for depreciation or a compound credit to Reserve for Depreciation and Reserve for contingencies, as for example,

Depreciation	Reserve for Depreciation	Reserve for Contingencies
$2,000	$1,500	$500

Such practice does not represent approved practice because the purpose of depreciation is to keep the original capital intact

by gradually recovering its wasting away through cost. To charge into costs a possible future contingency is not sound accounting practice, because it inflates costs and hence makes the buyer an unwilling victim.

The best practice for guarding against rising replacement costs is to set up a reserve for contingencies by debiting surplus and crediting reserve for contingencies, *vis.*,

Surplus		Reserve for Contingencies	
\$5,000			\$5,000

Contingency reserves of any sort find difficulty in surmounting the scrutiny of the government income tax accountants, and hence great care must be used in setting them up on the books of a company.

SUMMARY

In Chap. XX, the following important accounting points were emphasized:

1. The inclusion of interest as a "cost" is one of the most debatable of accounting problems. Where costs are used for comparative purposes, interest must be used to show true comparisons. For income-tax purposes it must *not* be used in evaluating final inventories because the government has ruled against such inclusion.

2. The trend of thought among industrial engineers is in favor of the inclusion of interest as a cost.

3. Purchase and sales discount may be treated either as financial management items or as a reduction of cost of goods purchased, and a reduction in the selling price. It is important that whichever viewpoint is adopted, that it be uniformly administered to both Purchase and Sale accounts.

4. In determining a normal point in distributing factory expenses, a reasonable average of the maximum plant capacity shall be used. This may be 80% of maximum capacity, or may be determined by averaging the production for a number of representative years.

5. Depreciation shall *not* be calculated upon replacement cost. Directors should guard against higher replacement costs by reserving a reasonable amount of surplus for such contingencies. It is the purpose of depreciation to keep the original capital intact, and its function stops there.

CHAPTER XXI[1]

MODERN MECHANICAL METHODS OF PERFORMING THE ACCOUNTING FUNCTION

OBJECT OF CHAPTER: To show the application of modern accounting machinery.

Accounting Principles and Accounting Machines.

Along with the advances made in recents years in the transfer or skill and thought in the machines used for manufacturing, there are now similar advances being made in the field of accounting. Pen-and-ink methods cannot keep pace with the ever increasing demands for detailed information required by industry. These demands have led to research, and there are now available many good makes of accounting machines which will take care of all the phases of bookkeeping and accounting. In these days of keen competition, close buying and selling, the item of bookkeeping overhead is too great to be ignored.

Accounting machines do not change the principles of accounting; they simplify it and enhance the positiveness of results by uniform handling of details.[2] The main difference, therefore, between bookkeeping machines, is principally in their design and hence in their detail of operation to secure conventional results. The principal advantages of bookkeeping machines are as follows:

1. The accounts are more legible.
2. The speed of posting is much greater than that with the pen-and-ink methods.
3. A proof of accuracy is furnished with each operation.
4. All work is completed day by day so that a daily balance is available for control accounts.
5. The possibility of human error in adding and subtracting is eliminated.

[1] The illustrations of machines and diagrams used in this chapter are reproduced by permission, and through the courtesy of the individual manufacturers.

[2] See SCHNACKEL and LANG, "Accounting by Machine Methods."

6. The amounts are added and subtracted automatically at the same time they are recorded so that the correct balance is shown just as soon as the last posting is made.

7. The manifolding properties of the machines make possible the production of several related forms in one writing.

In the use of accounting machinery great emphasis is placed upon direct-ledger posting as will be noted in the illustrations that follow. The T account as such is displaced by a ledger sheet as shown below. Thus for a charge account, debits are added and credits subtracted. The old balance is picked up by the machine, a debit added, a credit subtracted, and the result is a new balance. In addition, the majority of machines furnish a proof of the transaction.

NAME MR. JOHN DOE
ADDRESS ANYTOWN U. S. A.

PROOF	DATE	DESCRIPTION	FOLIO	DEBIT	CREDIT	BALANCE	PROOF
	JAN	BALANCE BROUGHT FORWARD				12 50	
12 50	2		123	10 00		22 50	12 50
22 50	4		142	6 25		28 75	22 50
28 75	5		156	7 55		36 30	28 75
36 30	7		160	12 35		48 65	36 30
48 65	10		C12		12 50	36 15	48 65
36 15	12	ALLOWANCE	CM9		3 25	32 90	36 15
32 90	14		182	13 85		46 75	32 90
46 75	20		190	23 75		70 50	46 75
	FEB						
70 50	1		210	32 15		102 65	70 50
102 65	3		221	19 10		121 75	102 65
121 75	5	FREIGHT ALLOWANCE	F21		6 40	115 35	121 75
115 35	10		C23		70 50	44 85	115 35
44 85	15		256	21 15		66 00	44 85
66 00	18		271	11 35		77 35	66 00
77 35	24		290	37 80		115 15	77 35
115 15	28		298	24 20		139 35	115 15

FIG. 82.

The old mixed transaction under such modern methods disappears entirely. For example, if a sale of $1,000 is made, $500 being paid in cash, and the balance carried on account, the customer's account is charged with the full $1,000. Through the cash records he is credited with $500 which is reflected on the credit side of his account. Subsequent payments on the account are then reflected merely as credits to the account through the cash records. In this way, each account gives a complete history of the transactions of the customer.

The Business Machines and Equipment Digest, an organization which makes an impartial research into all forms of mechanical accounting machinery, gives the following comprehensive review of bookkeeping machines (Sec. 8, p. 4):

Irrespective of the individual application, the functions of bookkeeping machines divide themselves roughly as follows:

FUNCTIONS OF BOOKKEEPING MACHINES

Posting:
- Accounts Receivable
  - Customers' Ledger
  - Customers' Statements
  - Sales Distribution
  - Control Accounts
- Accounts Payable:
  - Purchase Ledger
  - Commission Ledger
  - Voucher System
  - Invoice Register
  - Check Register
  - Remittance Advice
  - Control Accounts
- Expense Ledger:
  - Distribution
- Stock Records:
  - Requisitions
  - Perpetual Inventory
  - Simultaneous Production of Quantity and Value Results
- Payroll:
  - Distribution
  - Checks and Vouchers
  - Employee's Earnings Records

Proving Each Entry:
- That the amount is correct
- That the posting has been made in the right column
- That distribution is correct and complete

Old Balances:
- That they have been properly picked up

New Balances:
- That they have been properly extended

Debits:
- That postings equal total of invoices

Credits:
- That postings equal total of cash, allowances, discounts, etc.

Controlling:
- Totals of all general ledger accounts, individual ledgers, etc., coordinating all accounts under master or several subsidiary controls

Classifications of Bookkeeping Machines.

The machines now on the market are of the following types:

1. Combination typewriter, adding and subtracting machines:

   (*a*) with individual column registers:
   Elliott-Fisher
   Remington
   Underwood
   Burroughs Moon-Hopkins.

   (*b*) with individual column registers and a cross-computing register:
   Elliott-Fisher
   Remington
   Underwood

Burroughs Moon-Hopkins.

(*c*) with a single main totalizer:
Ellis.

(*d*) with two main totalizers.
Elliott-Fisher[1]
Ellis
Remington[1]
Underwood[2]
Burroughs Moon-Hopkins.

2. Adding-machine construction:

(*a*) direct subtracting with one or two totalizers
Burroughs
Dalton
Ellis
Sundstrand.

3. Adding-subtracting-multiplying machines; typewriter construction; direct subtracting with vertical and cross-computing registers:
Burroughs Moon-Hopkins.
4. Selective group-totaling and grand-totaling vertical registers, and cross-computing registers:
National.

Cross-computing or cross-footing is a term applied to such machines as are capable of accumulating or subtracting amounts as they are posted at different positions across a form. Combination machines are equipped for both vertical and cross-computing, rendering individual vertical column totals as well as a total of a cross-computation.

Vertical computing is a term applied to bookkeeping machines having individual registers to add or subtract amounts posted in vertical column formation. Machines with a single counter, of course, compute amounts of vertical as well as cross-postings. They provide but one total, however, and therefore, cannot provide column totals while they are accumulating across the sheet.

[1] Indicates that these machines may be equipped either with two registers on the cross-footer truck, or with a split single register, to provide separate totals of quantity and value.

[2] Indicates that this machine may be governed by adjustable stops to cross compute or double compute in more than one register.

Illustrations of the Use of Accounting Machines.

While it is obviously beyond the scope of this text to explain the detail of operation of the various makes of accounting machines, it is believed that a number of accounting illustrations of representative machines will better serve to illustrate their use. The Equipment Research Corporation of Chicago is constantly making impartial studies of the details of operation of all standard accounting machines and the reader is referred to Sec. 8 of their publication *The Business Machines and Equipment Digest* for such details.

Remington Bookkeeping Machine.

Model 23 The Remington bookkeeping Machine will handle the entire bookkeeping job. Billing, customer's statement and ledger, accounts payable, remittance vouchers, operating and expense ledger, cost records of all kinds, cash receipts and disbursement records, distribution of purchases, sales, costs, and expenses, payroll, and check writing, stores and material inventory ledgers and hundreds of other applications, are included in the scope of this machine.

All totals are automatically accumulated, all balances are mechanically computed and extended, and all proofs are secured without any effort on the part of the operator. All names, addresses, descriptions and identifications are written on the same machine, at the same operation.

The Remington has a front feed mechanism. Forms are inserted from the front without revolving the platen. Several related forms may be collated, inserted, and registered at one operation. An audit sheet furnishes a continuous record of all entries posted without any effort on the part of the operator. This record is spaced automatically and is always in position for the next entry, regardless of the position in which it is being posted on the individual account. No entry can be written over a previous one.

The ten adding keys of the Remington Bookkeeping Machine are separated from the alphabet keys and placed in the most convenient position—directly under the finger-tips of the operator. It is not necessary to employ special machine operators or typists. Present bookkeepers or clerks may be easily and quickly taught how to operate these machines.

The illustration which follows is representative of the type of work done by this class of accounting machine.

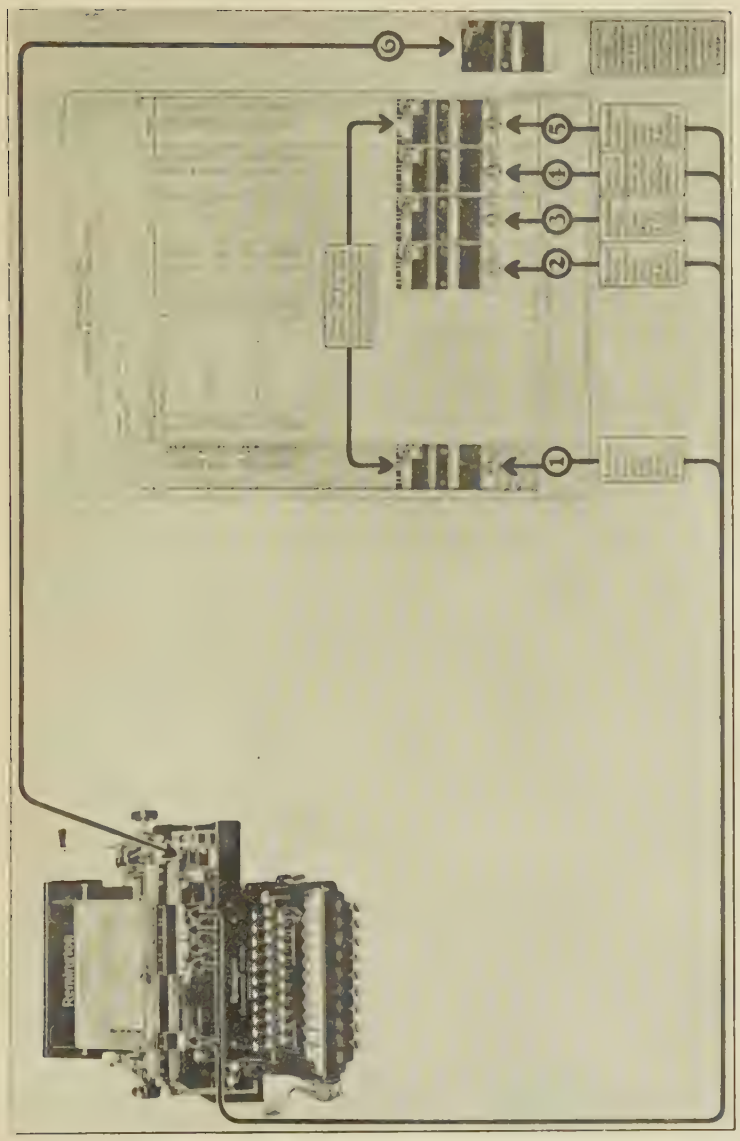


Fig. 83.

Burroughs Machines (see Figs. 84, 85, and 86).

The Automatic Ledger and Statement Posting Machine.—The Burroughs Automatic Ledger and Statement Posting Machine posts the ledger, writes the customer's statement (both originals), and proves the accuracy of the work in one operation. With each posting, ledger and statement are balanced. The condition of any account can be determined by merely glancing at the ledger sheet. Statements are always ready for mailing. Month-end peak loads are eliminated.

Debit Posting Medium.—A shipping and charge sheet, in triplicate, is made for each order received from traveling salesmen or obtained in the branch office display room. The original copy of this sheet serves as a debit posting medium. The duplicate copy is sent to the customer, and the third is the office copy.

Ledger.—The Burroughs Automatic Ledger and Statement Posting Machine and one operator handle about 800 debit postings daily and 500 credit postings weekly. Date, description, folio and debit or credit are posted simultaneously. The machine automatically selects the proper columns for debit or credit postings. Before installing the machine, two bookkeepers were kept busy on the ledgers.

Customer's Statement.—After posting the ledger, the machine automatically tabulates to the statement—automatically reprints date, description, folio and debit or credit, and automatically extends the balance. The machine posts and balances both ledger and statement and furnishes a proof of the accuracy of the work. Statements are in balance every day and can be rendered to customers on a moment's notice.

Automatically Proves the Work.—The proof strip is automatically controlled, moving in and out of printing position without attention from the operator. After each posting the old balance is subtracted, leaving the amount of the credit or debit to be printed on the proof strip. The total of the items printed on the proof strip checked against the total of the debits taken from the charge and shipping sheets, proves that each old balance was picked up correctly, and that every item was correctly posted. Any error is quickly localized and corrected.

Debit Memorandum.—If, when billing or when issuing a credit, an error is made in favor of the customer, a debit memorandum in quadruplicate is issued. The original copy is mailed to the customer. The duplicate copy serves as a debit-posting medium.

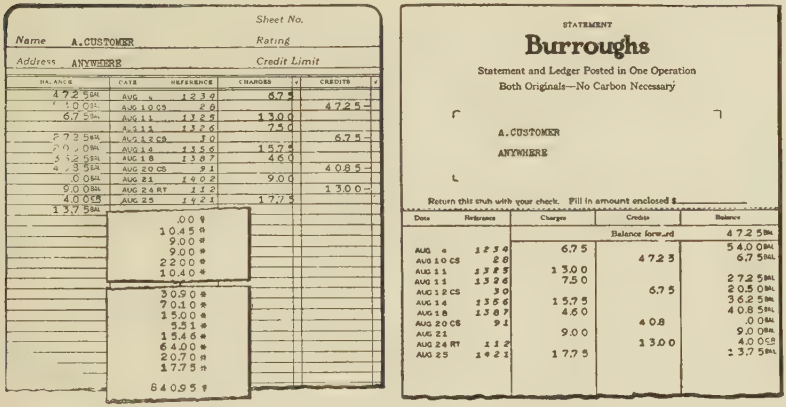


FIG. 84.—The Burroughs automatic ledger and statement machine.

Ledger and statement (or remittance advice), are posted in one operation on the Burroughs automatic ledger and statement machine. As the ledger and statement are written the machine automatically provides a printed proof of the accuracy of all figures on both ledger and statement. Ledger, statement and proof are originals. No carbons are used. Statements are always ready for mailing. There is no peak load at statement time.

The machine may also be used for posting the general ledger, and on miscellaneous work. It is made in a number of styles, with or without folio section, to meet various requirements.

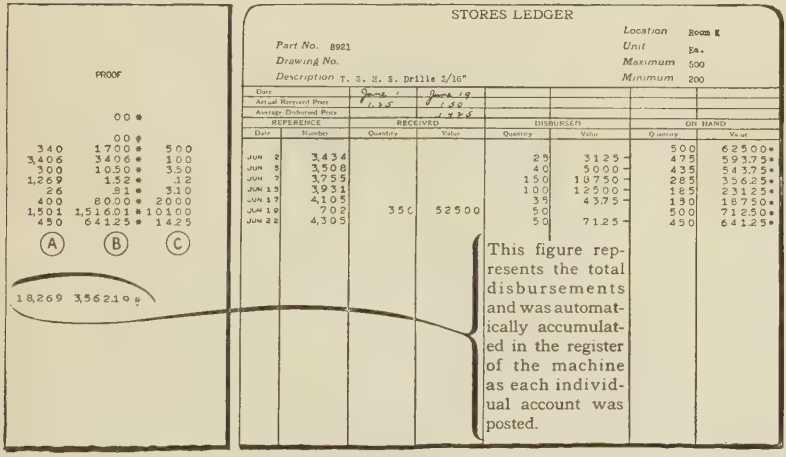


FIG. 85.—The Burroughs stock record machine.

The forms at the left were made on the Burroughs stock record machine, which posts quantity and value simultaneously, and automatically extends a new balance on both with each posting. A sound method of proof establishes the accuracy of all work even beyond the posting of the stock ledgers. The machine automatically accumulates total receipts or disbursements.

This is only one of the stock record plans offered by Burroughs. Other methods provide records of quantity only, or value only, with or without typewritten description. Through such a wide range of machines, Burroughs offers a choice of the method best suited to the business—reducing time and cost of the work, and furnishing automatic proofs.

BURROUGHS ADDING MACHINE COMPANY 49614

Refer to Invoice Number

Customers Order No. & Date 6764
Requisition No.
Contract No.

Invoice Date 8/20/29
Vendor's Nos.

FOR CUSTOMER'S USE ONLY
Register No. | Voucher No.
F. O. B. Checked
Terms Approved | Price Approved
Calculations Checked
Transportation
Freight Bill No. | Amount
Material Received
Date 19 | Signature | Title
Satisfactory and Approved
Adjustments
Accounting Distribution
Audited | Final Approval

. A CUSTOMER
. ANYWHERE (1)
U.S.A.

Shipped to & Destination
Date Shipped
Car Initials & No.
How Shipped and Route
Terms 2% 10 DAYS

From
F. O. B.
Prepaid or Collect COLLECT

QUANTITY	DESCRIPTION		UNIT PRICE	AMOUNT
29 DZ	FR PLIERS (2)	975	28275 (3)	
10 DZ	KNIVES	1250	12500	
			40775	
	LESS 60-10-5% (4)			13945
½ DZ	FLASH LIGHTS	225	113	
975	¼" HEX NUTS	325 M	317	
			430 (5)	
	LESS 15%			366
				14311 (6)

Please make all checks Payable to Burroughs Adding Machine Company

FIG. 86.—The Burroughs typewriter billing machine.

This machine will write and compute a complete bill in one operation—including typewritten itemization, direct multiplication, automatic extension and totals.

All of the billing machines manufactured from this base model have a full standard typewriter keyboard and complete adding and multiplying sections.

The machine will carry several different totals at one time, any one of which can be added to or subtracted from any other total directly. All calculations are handled automatically

The triplicate copy is the office copy. The quadruplicate copy goes to the sub-branch making the charge.

Credit-posting Medium.—Upon receipt of a customer's check, the first step is to determine what items the check covers. If the remittance is correct, a settlement sheet is made up by the bookkeeper, in one copy, which serves as a credit posting medium.

Credit Memorandum.—If goods are returned by the customer, a returned-goods memorandum is made and sent to the claim department, where a credit memorandum, in quadruplicate, is issued. The original goes to the customer. The duplicate serves as a credit-posting medium. The triplicate is the office copy. The quadruplicate goes to the subbranch. At the end of the month, the total of credits posted must equal the amount of credits issued by the claim department, plus the Accounts Receivable credits in the Cash Book.

The illustrations which follow in Figs. 84, 85 and 86 are typical of the work of the Burroughs Machines.

Elliott-Fisher Machines.

The Elliott-Fisher Simplified Accounting Machines differ from those previously described in that it features a *flat writing surface.* Very frequently, particularly with the small business or subsidiary company, all business records can be kept in one book without in the least impairing the efficiency of the business accounting procedure. By means of the flat writing feature this is possible. Figure 87 is an illustration showing diagrammatically the features of this machine.

Another feature of the machine, through its flat-writing principle, is to produce a large number of copies rapidly and economically. In cost accounting, this feature often is necessary and its application to such a problem is illustrated in Fig. 88.

---

with printed proof of their accuracy. These machines are equipped to handle direct multiplication of fractions.

Since this machine performs all multiplications, subtractions and extensions, and accumulates the individual and grand totals, most bills can be typed and computed on this machine in less time than it takes the ordinary typist merely to copy the bill.

1. Typewrites the name, address, dates, terms and other information on the head of the bill.
2. Complete typewritten itemization and description. This Burroughs has a standard typewriter keyboard.
3. Automatically extends and prints the amount. No copying—one key depression prints entire amount of the extension.
4. Automatic computation and subtraction of all discounts from individual items or, if you prefer, from the complete bill.
5. Automatically accumulates and prints group totals in one or more columns whenever desired. In this particular case, the machine added the gross amounts of three items then computed the discount and printed the net result; thus saving the time of figuring three separate discounts. This is a group total—not a sub-total.
6. Automatically accumulates and prints the net total of the bill.
7. Automatically retains the net total of the bill and accumulates it with the net totals of other bills, thus giving a grand total of the day's billing.

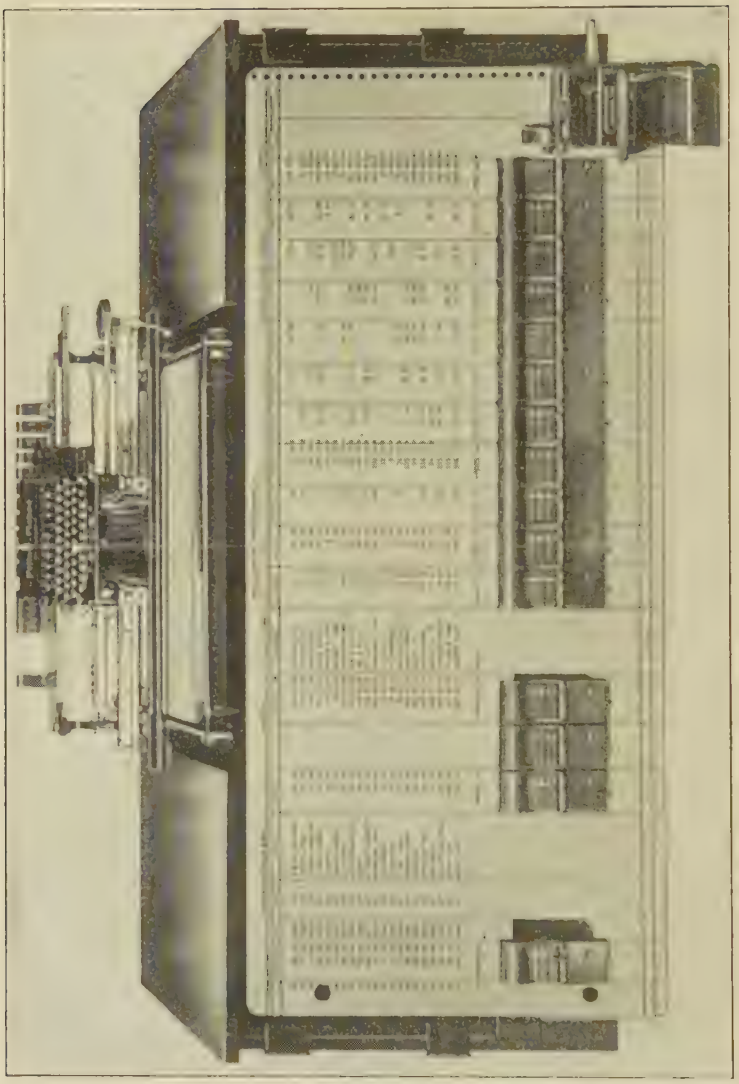


FIG. 87.

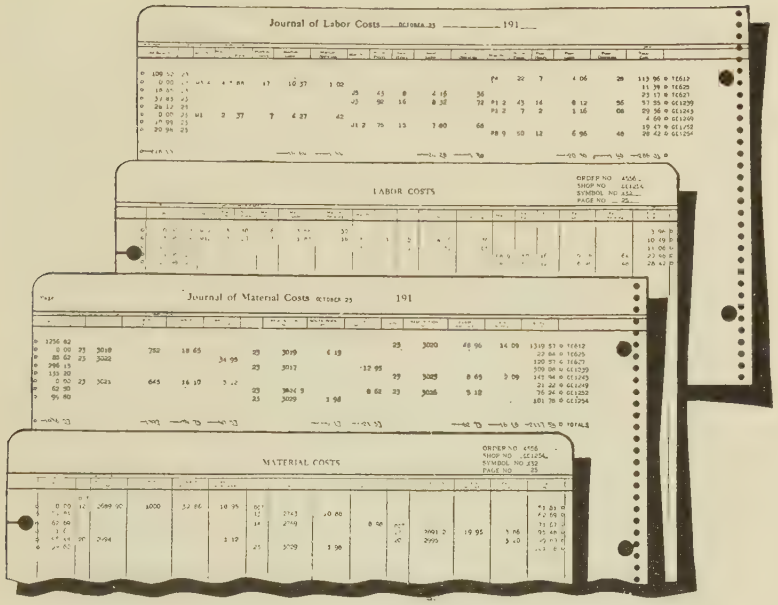


FIG. 88.—Progressive labor and material costs and journals produced on Elliott-Fisher Machines.

These forms indicate a wide segregation of costs by classes of expenditure, under labor, material and job classifications.

A separate account is carried under each shop number for labor and material expense and the items entering into the expense of each job are accumulated progressively.

The material cost account and journal are written at the same time and each complete line entry is proven at the time it is made.

Labor costs are similarly computed on each labor cost account and journal.

While the card accounts show progressive totals when covering those items entering into the particular job, the daily journals show the total of all costs entering into every job in progress each day.

Additional desirable records may be added and likewise written in a single operation without the necessity of having to handle separate carbon sheets.

The Elliot-Fisher flat-writing surface makes it possible to combine like records of any necessary size, shape or thickness.

It frequently happens that the number of distributions necessary to furnish all essential information becomes so great that columnar distribution becomes unwieldly. In such instances, the ability of Elliot-Fisher to collectively write a number of relative forms readily lends itself to the adaptation of unit distribution accounts with columnar breakdowns.

The use of the automatic audit sheet furnishes positive proof of the accuracy of the work and supplies an accessible checking medium in case a typographical error occurs.

Elliott-Fisher Automatic Feed Machine.—In recording the daily transactions of any business, records such as orders, bills, requisitions, shipping documents, etc., that involve writing an original and one or more copies are absolutely necessary.

When cut or padded forms and loose sheets of carbon paper are used in the preparation of such multicopy records, the clerk is compelled to go through a series of time-consuming, non-pro-

Fig. 89.—Elliott-Fisher single automatic feed machine.

ductive operations in connection with the completion of every set of forms prepared each day.

The Elliott-Fisher Automatic Feed Machine reduces the work of preparing multicopy records to one operation and permits the clerk's efforts to be devoted entirely to actual writing—productive work.

This result is accomplished by using continuous length forms instead of cut or padded forms and continuous length carbon

paper instead of loose carbon sheets. Figures 89, 90, 91 and 92 are illustrations of this type of work.

Tabulating, Accounting, and Analysis Machines.

The Hollerith or International and the Powers machines are outstanding in this field. In the use of these machines all information is reduced to small "punched hole" cards (Fig. 93). "Light through punched holes" is the common expression in

Fig. 90.—Elliott-Fisher double-barrel automatic feed machine.

connection with their use. Particularly in the larger organizations where the need for statistics is great these machines are invaluable.

Briefly, their operation is as follows. The information is punched upon cards as shown in Fig. 93.

The punching operation is performed upon a key punch which is operated similarly to a typewriter or adding machine. The cards are then taken to the sorter (see Fig. 96) where they are sorted according to the information desired. Thus, if a pay-

roll was being compiled the sorter would be set for certain numbers and the cards assorted into separate slots according to the number of each workman. The cards would then be taken to the tabulator which would tabulate the amount and give the payroll summary (see Fig. 94).

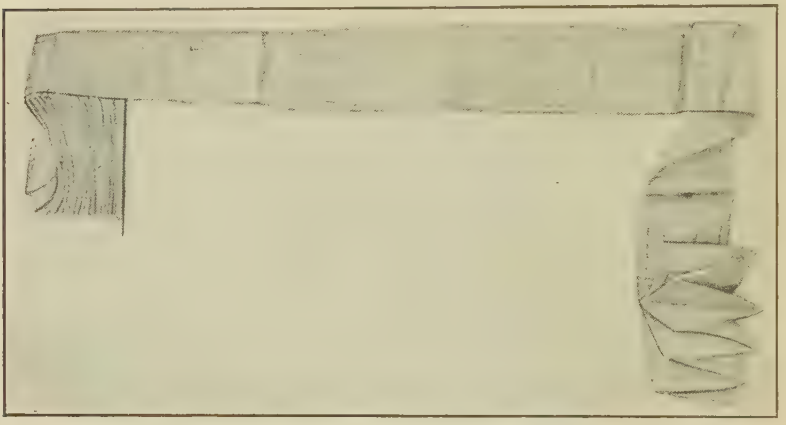


Fig. 91.—Superfold forms.

Payroll is just one of the many important uses to which these machines may be put. They find a great field of usefulness in analyzing sales statistics, analyzing cost records, keeping statistics in life insurance companies, and in analyzing census figures (see Figs. 99 and 100). It was in the latter field that they first came into prominence.

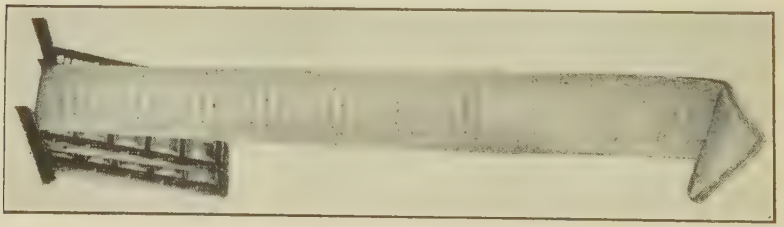


Fig. 92.—Roll forms.

The illustrations in this chapter are of the International and Powers machines. They are very similar in their operations. The International machine accomplishes the sorting function by electrical contacts, while the Powers performs the function mechanically.

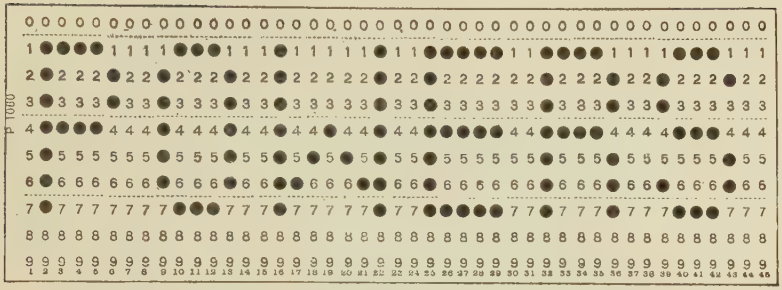


FIG. 93.

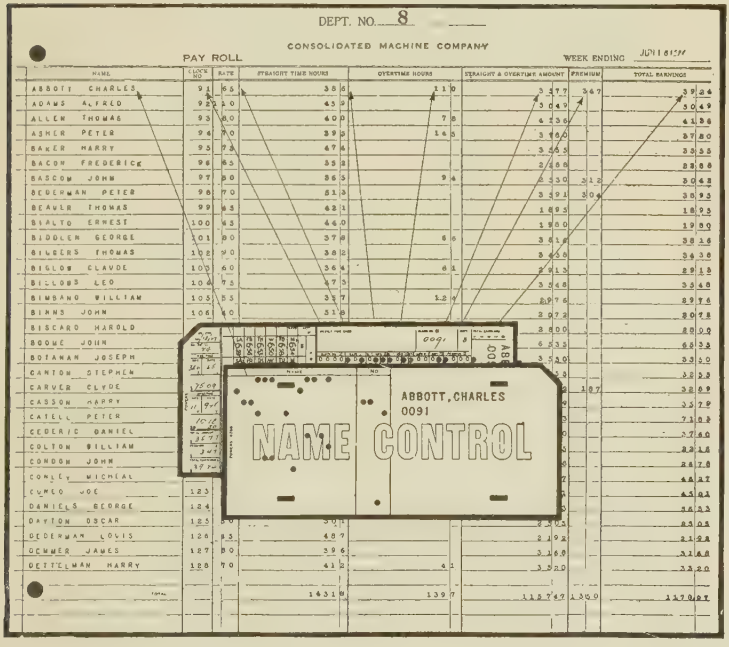


FIG. 94.—Payroll sheet prepared on the Powers alphabetical tabulator. This sheet printed and totalled in less than two minutes time from the Powers in-and-out clock cards and name control cards also shown here. This sheet completed and ready for payroll binder.

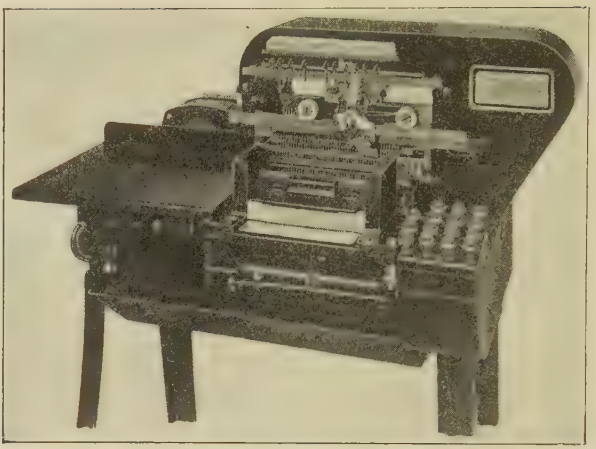


FIG. 95.—The Powers alphabetical punch, with standard typewriter keyboard, automatic carriage return, back spacer, and other revolutionary improvements, prepares the Powers card.

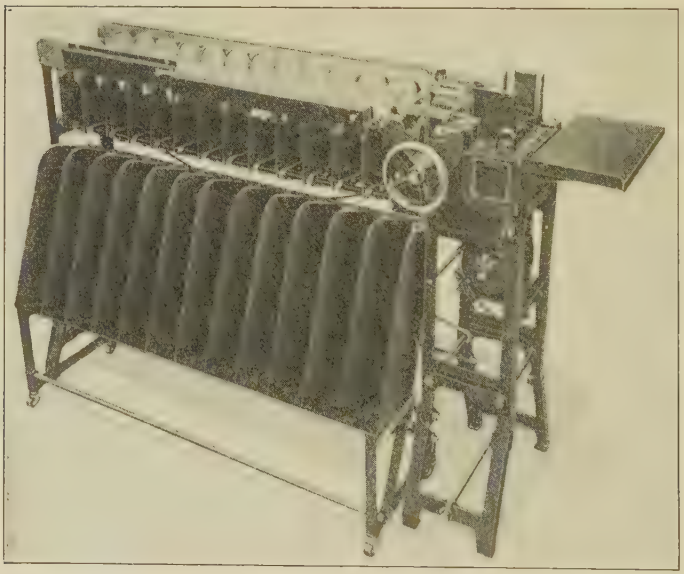


FIG. 96.—The Powers automatic sorter, with its positive action and self-control mechanism, arranges accounting details in classifications or groupings of any desired order.

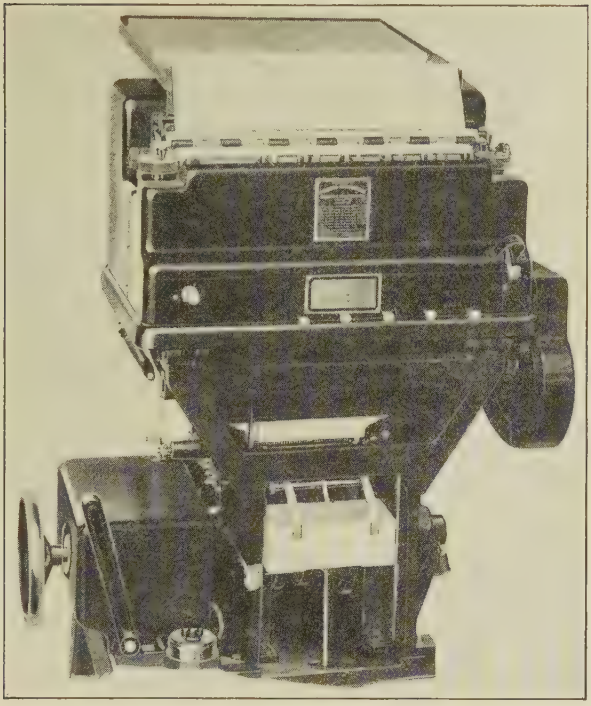


FIG. 97.—The Powers printing tabulator, prints automatically in statement form from prepared Powers cards, names and words, as well as figures.

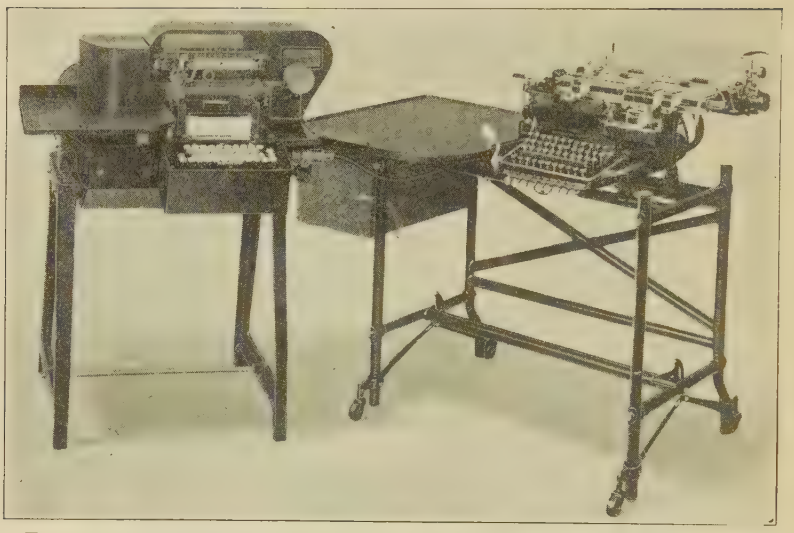


FIG. 98.—The Powers typewriter-key punch, "hooked-up" to and synchronized with the Remington bookkeeping machine. This combination makes it possible to punch cards and make bookkeeping entries at the same time.

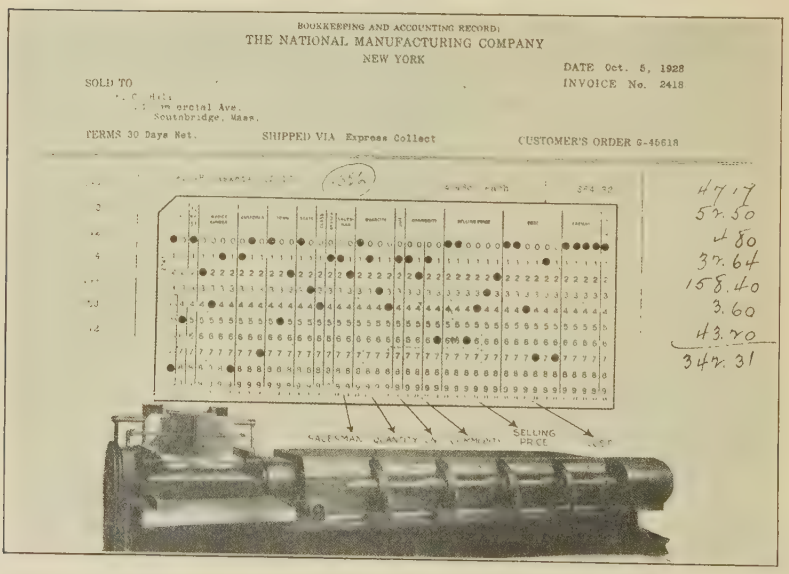


FIG. 99.

ANALYSIS OF
BRANCH SALES AND PROFITS

March

	TOTAL		BOSTON		NEW YORK		PHILADELPHIA		CHICAGO	
SALES:	177,174	84	32,193	80	57,496	21	38,791	73	48,693	10
	60,476	46	5,375	18	17,483	22	18,432	60	19,185	46
(Specify Departments	124,434	23	14,831	09	46,417	08	21,916	17	41,269	89
or Principal	42,286	70	17,216	15	8,103	27	4,206	18	12,761	10
Commodities)	7,086	68	1,321	19	2,716	83	2,302	12	746	54
	15,445	33	2,116	75	6,561	98	4,713	29	2,053	31
GROSS SALES	426,904	24	73,054	16	138,778	59	90,362	09	124,709	40
RETURNS & ALLOWANCES:										
Returned Goods	8,360	30	714	10	1,387	25	2,910	86	3,348	09
Allowances	2,134	74	41	18	304	21	595	12	1,194	23
Policy Adjustments	2,533	60	217	21	101	22	375	94	1,839	23
Total	13,028	64	972	49	1,792	68	3,881	92	6,381	55
NET SALES	413,875	60	72,081	67	136,985	91	86,480	17	118,327	85
COST OF GOODS:	323,698	53	59,034	83	105,635	35	65,378	29	93,650	06
GROSS PROFIT	90,177	07	13,046	84	31,350	56	21,101	88	24,677	79
% Gross Profit to Net Sales	21.8		18.1		22.9		24.4		20.9	
EXPENSE:										
Salesmen's Salaries and Commissions	15,337	50	2,296	51	4,832	70	3,992	18	4,216	11
Salesmen's Expenses	4,302	32	407	91	1,807	42	852	12	1,234	87
Branch Office Expenses	5,212	39	837	18	2,127	69	912	09	1,335	43
General Office Expenses	4,315	42	751	75	1,428	40	901	49	1,233	78
Advertising Expenses	2,302	00	400	66	761	30	482	47	657	57
Administration Expenses	8,747	60	1,523	83	2,895	46	1,827	37	2,500	94
Total Expense	40,217	23	6,217	84	13,852	97	8,967	72	11,178	70
% Expense to Net Sales	9.7		8.6		10.1		10.4		9.4	
BAD DEBTS:	5,531	86	567	38	1,328	76	1,026	94	2,608	78
Total Deductions	45,749	09	6,785	22	15,181	73	9,994	66	13,787	48
NET PROFIT	44,427	98	6,261	62	16,168	83	11,107	22	10,890	31
% Net Profit to Net Sales	10.7		8.7		11.8		12.8		9.2	

FIG. 100.—One of the many reports secured from tabulating cards.

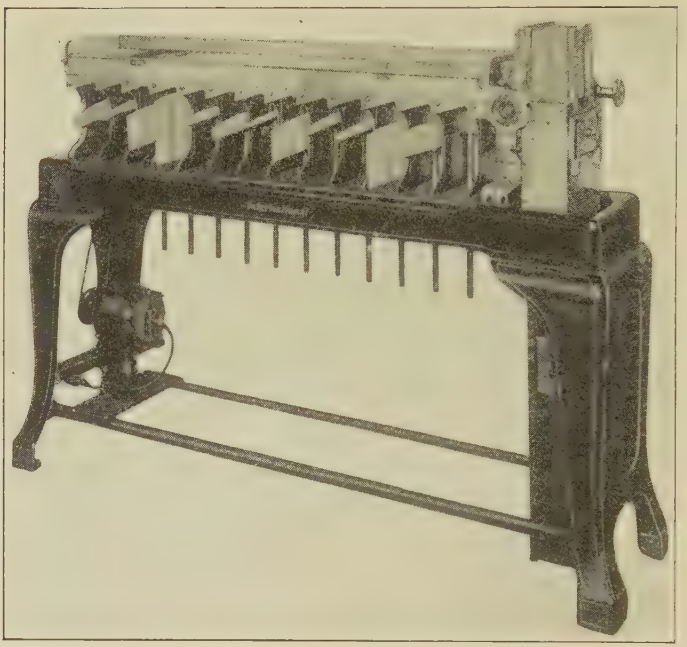


FIG. 101.—International electric sorting machine; horizontal type.

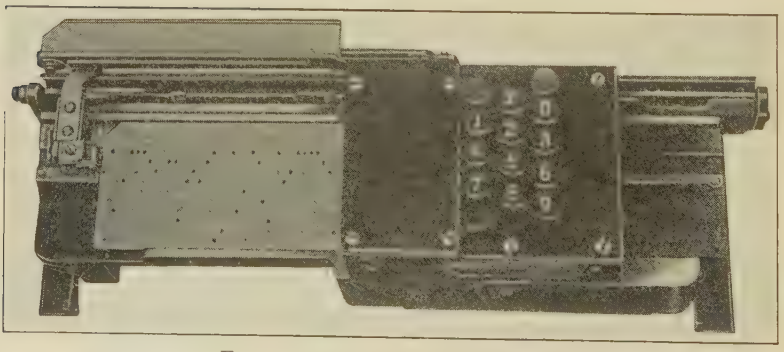


FIG. 102.—The electric key punch.

This unit of the electric tabulating and Accounting machine method is used to perforate the original sales data in the Tabulating cards, thereby preparing permanent, unalterable, accurate records. The limited number of punching keys and their extremely light touch assure the rapid acquirement of skilled operation.

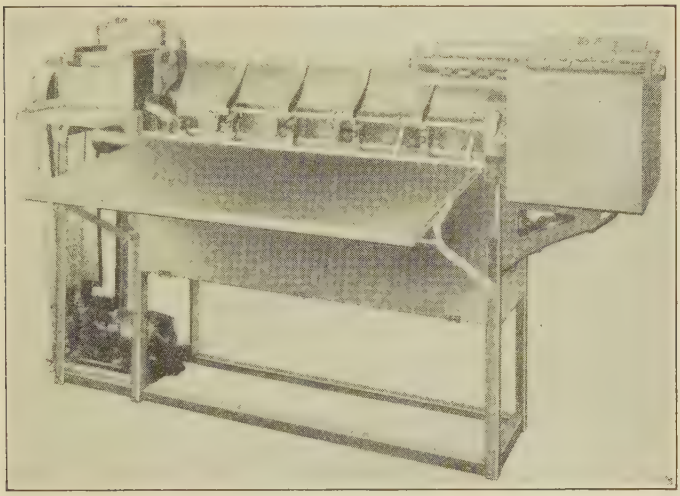


FIG. 103.—The electric accounting machine.

The electric accounting machine prepares printed reports, either on regular ruled forms or on paper fed from rolls. These reports or memoranda can be compiled showing the totals for each group or classification together with accumulated totals for all groups.

The electric accounting machine can be instantly transformed to list the detailed information punched on each card and print the totals of each group or classification.

Group totals for one to five classes of data are secured at a speed of 150 cards per minute. When an itemized list is required, from one to seven columns or classes of detail together with totals of five of these classes are supplied at the rate of 75 cards per minute.

REFERENCES

(Chapters XIII to XXI, Inclusive)

ALFORD, L. P., "Representative Policies and Methods for Purchasing New Equipment"; *Manufacturing Industries;* a series of articles beginning October, 1927, p. 277.

A. S. M. E., *Journal*, September, 1923.

ATKINS, P. M., "Textbook of Industrial Cost Accounting."

BARNES, R. H., "When—New Machines or Old?" *Factory and Industrial Management*, June, 1928, p. 1188.

BERLINER, J. J., "To Scrap or Not to Scrap," *Factory and Industrial Management*, April, 1928, p. 784.

BLISS, J. H., "Management Through Accounts"; "Financial and Operating Ratios."

CARTWELL, M., "Stores and Materials Control."

CASTENHOLZ, W. B., "Cost Accounting Procedure."

CHURCH, A. H., "Manufacturing Cost and Accounts," 1929.

CURTIS and COOPER, "Mathematics of Accounting."

Department of Manufacture, Chamber of Commerce of U. S., Washington, D. C., "Budgeting for Business Control"; "Cost Accounting Through the Use of Standards"; "Depreciation—Treatment in Costs"; "Group Depreciation Studies"; "Overhead Expenses"; "Perpetual Inventory and Stores Control"; "The Evolution of Overhead Accounting"; "Uniform Cost Accounting in Trade Associations," Parts I, II, and III; "What a 'Cost System' Should do for You."

DOHR, J. L., "Cost Accounting."

DU BRUL, E. F., "Some Common Delusions Concerning Depreciation," *A. S. M. E. Journal*, May, 1928.

Equipment Research Corporation, "The Business Machines and Equipment Review."

FICKER, N. T., "Industrial Cost Finding"; "Shop Expense Analysis and Control."

FINNEY, H. A., "Principles of Accounting," Vols. I and II.

FORDHAM and TINGLEY, "Organization and Budgetary Control in Manufacturing."

GILMAN, S., "Analyzing Financial Statements."

GUTHMAN, H. G., "Analysis of Financial Statements."

HARRISON, G. C., "Cost Accounting to Aid Production"; "Installing Standard Cost," a series of articles in *Manufacturing Industries*, beginning September, 1927, p. 193.

HATFIELD, H. R., "Modern Accounting."

HIMMELBLAU, D., "Complete Accounting Course."

JORDAN and HARRIS, "Cost Accounting—Principles and Practice," 1925.

KENT, W., "Bookkeeping and Cost Accounting for Factories."

KIMBALL, D. S., "Principles of Industrial Organization," 1925.

KOHLER and MORRISON, "Principles of Accounting."

KONOPAK, L. T., "Cost Accounting Fundamentals."

LAWRENCE, W. B., "Cost Accounting."

MCKINSEY, J. O., "Budgetary Control."

Manning, A. B., "Elements of Cost Accounting."
Montgomery, R. H., "Financial Handbook."
National Association of Cost Accountants, Year Book for 1927.
Newlove, G. H., Article on Depreciation, *Journal of Accountancy*, December, 1928.
Prentice-Hall, Inc., Federal Tax Course.
Salier, E. A., "Accountants Handbook"; "Principles of Depreciation."
Schlatter, C. F., "Elementary Cost Accounting."
Schnackel and Lang, "Accounting by Machine Methods."
Scovill, C. H., "Interest as a Cost."
Stockwell, H. G., "How to Read a Financial Statement"; "How to Read a Profit and Loss Statement."
Toner, J. V., "Mathematics of Finance."

INDEX

A

Account, balance, 31
  classification, 48, 49
    manufacturing plant, 51
    Wisconsin C. P. A. problem, 57–60
  definition and technique, 15
  mixed, 26
  profit and loss, 30–32
  subscriber, 176
  surplus, 169
  T account, 15
Accounting, basic books of, 32
  complete problem, 93–114
  controversial and debatable subjects, 93–114
  definition of, 4
  establishment of policy of, 356
  machines, Burroughs, 424–427
    classification of, 420
    Elliott Fisher, 427–431
    functions of, 420
    illustrations of use of, 422
    International Analysis and Tabulating, 431–439
    Powers Analysis and Tabulating, 431–439
    principles of, 418
    Remington, 422–423
  period, comparison of one with another, 63
    length of, 90
Accounts, asset, 15
  controlling, 142–144
    accounts payable, 146, 147
      receivable, 146, 147
    complete problem, 153–155
    definition of, 144
    diagram of, 143
Accounts, controlling, effect on books of original entry, 150
    factory ledger, 149
    principal kinds of, 144, 145
    self balancing, 146, 147
    (*See also* Control.)
  Procedure for posting to T accounts, 17
    problem on, 19
Actuarial science, 276
  (*See also* Financial mathematics.)
Adjusting entries, 62, 66
  transferring to books, 92
Adjustment entries, seven types of, 66
  merchandise inventory, 67–69
Alford, L. P., 2, 326, 328
Amortization, comparison with sinking fund, 286
  interest bearing indebtedness, 285
Assets, 16, 17
  classification of, 10
  current, 48–50
  deferred, 50
  fixed, 48–50
  intangible, 50
Assets = Liabilities + Capital, 4, 8, 16, 17, 21, 22
A. S. M. E., Material handling formulas, 404, 405
  application of, 405–407
Automatic, multiple spindle, 320

B

Balance of stores, clerk, 205
  ledger, 144, 148
Balance sheet, 6, 7, 9, 11, 12
  analysis, 387
    of two or more balance sheets, 391–393

Balance sheet, effect of type of organization upon, 168, 169
elements of a manufacturing company's, 10
estimated, 383, 384
form of, 12
opening, 41
picture of financial structure, 13
procedure for analyzing single balance sheet, 391
two or more balance sheets, 394, 395
representative problem to illustrate, 13
trend percentage method of analysis, 394
Barnes, R. M., 326
Bedaux International Co., 359, 360
method of labor analysis, 359–364
Berliner, J. J., 327
Bliss, J. H., 395
Bonds, coupon rate, 287
current rate, 288
shorter method of valuation, 289
valuation of, 287
yield rate, 288
Bookkeeping, definition of, 4
double entry, 17
problem to illustrate procedure, 41
Books, original entry, effect of controlling accounting upon, 150
Budget, constant and variable expense, 380
direct labor, 377, 378
material, 377, 378
financial, 377, 378
manufacturing expense, 377, 378
method of setting, 380
normalizing at activity, 381, 382
reports of realization, 384, 385
Budgetary control, a coordinated plan of, 377
advantages of, 384
chart of, 378
estimated balance sheet in, 383, 384
operating statement in, 382
profit and loss statement in, 383
Budgetary control, factory expense in, 378
principles of, 3
Business forms of organization, 164
magazine of, 5

C

Capital, 6, 15
permanent, 17
temporary income, 17, 21
outgo, 17, 21
stock subscriptions, 176, 177
Cash, accounting for, 135, 136
book, 6, 123
complete problem to illustrate, 129–131
four column, 150–152
petty cash, 136–138
problem to illustrate, 124, 125
petty, Imprest method, 136–138
Check system, 36
Closing, reason for, 91
when to, 92
Control, expense, 148
factory ledger, 149
finished stock, 149
plant ledger, 148
production, 2
raw material, 149
work process, 149
Controlling (*see* Accounts).
Controls, perpetual inventory, 148
Corporation, 163, 165
board of directors, 165
books of, 169, 176
change from partnership to, 179–182
opening entries of, 176–178
problems on, 179–182
Cost, basic material, 339
cost of goods sold, 25, 27
problem on, 29
economic effect of taking business at or below, 270–275
manufacturing cost of goods sold, 219, 220
system (*see also* Order Process *and* Standard).

Cost system, effect of continuous and intermittent industries upon, 210
necessary adjustments, 261
order, 337
process, 214
standard, 338
suggestions in designing of, 358
Costs (*see also* Standard costs).
order, 214
problem on, 221–225
process, 211–214
problem on, 212, 213
C. P. A., Massachusetts problem, 174
New York problems, 171, 187
Wisconsin problem, 57
Credit, 22, 23
side, 22

D

Debit, 22, 23
Debts, bad, 80
reserve for, 80–83
(*See also* Accounts receivable.)
Depletion, 307, 328
Depreciation, 307
a cost element, 307
advantages and disadvantages of different methods, 311, 312
curves, 319
guards against misconception, 323
methods of calculating, 308, 310, 311
most widely used methods, 309
original value in calculating, 309, 310
recording depreciation, 319, 322
replacement value in calculating, 416
reserve for, 77–80, 318
schedules, 312–319
Diagram, shop accounting system, 366, 377
Diagrammatic, ledger to illustrate single proprietorship, partnership corporation, 163, 164
plan, 32
standard cost plans, 366, 375
Discounts, cash, 140
purchase, 140, 141
sales, 140
trade, 139
Dispatch clerk, 207
Division of Labor, methods to insure, 115
Double record, 135

E

Electrical Manufacturer's Association, 53
Expense, factory, 225–227
overabsorbed, 217
underabsorbed, 217
Expenses, manufacturing, 149, 150
overhead, how to distribute them in good and bad times, 216, 217
underabsorbed and overabsorbed administrative and selling, 227, 228

F

Factory and industrial management, magazine of, 326, 327
expense, concrete illustration of, 262–267
inadequacy of distribution, 246, 247
loading rates, 248
machine rate method, 247–257
methods used in distributing, 243
direct labor, 244
material, 243
man-hours, 244
Mechanic rate, 245
normal operation, 260
year, 260
underabsorbed and overabsorbed, 260
(*See* Factory expense.)
ledger control, 228
manager, 203
overall pictures of accounts, 219
problem on accounts of, 221–225

Factory, three ways of keeping accounts, 228–241
underabsorbed and overabsorbed expense, 225–227
Financial mathematics, 276
algebraic expressions of, 277–283
compound interest tables for, 290–306
fundamentals of, 276
the amount of $1, 276–278
an ordinary annuity of $1, 276, 281
present value of $1, 276–280
an ordinary annuity of $1, 277, 282
interest compounding, 278
Finished goods, initial inventory, 219, 220
Fiscal period, procedure at end of, 62, 89

G

Gantt, H. L., 1, 2,
General Electric, 210
Gifford, W. S., 5
Gilman, S., 391, 394

H

Harrison, G. Charter, 3
Hatfield, H. R., 3
Hoskold's formula, 331

I

Idle plant capacity, loss due to, 268–270
Imprest method, petty cash, 136
problem to illustrate, 137, 138
Inadequacy, 307
effects of, 325
Income tax, considerations of, depreciation, obsolescence, depletion, 331–336
Industry, continuous process, 209
intermittent process, 209
method of keeping books in, 35–39
practical instructions from, 35
Insurance, prepaid, 63, 69
Interest, accrued, 75–77
earned but not yet received, 71
inclusion in costs, objections and answers concerning, 407–414
income deferred, 65
on investment, 404
reason for inclusion as a "cost," 404
non-inclusion as a "cost," 407
Internal check, 138, 139
Inventories, perpetual, 219, 358
Inventory, 26

J

Jones and Lamson, turret lathe, 206
Journal, 17, 32
compound entry, 115
general, 6, 126
opening entries, 41
rulings, 33
Journalizing, 41

K

Kemp, W. S., 337

L

Labor, basic operating, 319
direct, 215
indirect, 215
Ledger, 6, 32
diagrammatic plan, 21
division of, 142
factory, 147
general, 142, 143
controlling account, 149
plant or property, 319, 320
private, 150, 151
rulings, 33
schedule for posting to T accounts, 16
self balancing, 146
subsidiary, 142, 143
Lee, Prof. M. A., 198
Liabilities, 6, 10, 15–17
Loading, basic operating, 319

M

Machine rate method (*see also* Factory expense).
details of, 247–257
how to use, 257
methods of assigning machine class number, 256
page of machine rate book, 258
Maintenance, accounts, 56
Management, labor, 2
Manufacturing, accounts and statements of business, 209, 215
classification of indirect expense, 53–57
development of orders, 206
diagram of procedure, 204
general classes of, 209
industries, magazine of, 326
order, 203
statement, 224
Materials, direct, 215
indirect, 215
purchased, 149
received, 149
Mc Kinsey, Prof. J. O., 3
Merchandise, inventory, 26
adjustment, 67–69
old and new ways of handling, 25–27

N

Net worth, 8, 11
classification of, 11
(*See also* capital and proprietorship.)
Normal, (*see also* Factory expense).
costs, 358
determination of distribution rates, 415, 416
operation, 260
year, 260

O

Obsolescence, 307
effects of, 325
Operating statement, estimated, 382
Order cost, system, 337

P

Paciola, Luca, 2
Partnership, 163, 165
problems on, 170–174
admission of new partner, 173
dissolution, 174
distribution of profits, 171
organization, 170
Payroll, accrued, 73–75
distribution, 358
factory, 149
Planning, board, 203
superintendent of, 203
Posting, 6, 33, 41
Procedure, end of fiscal period, 62, 89
handling direct and indirect labor, 201
issuing raw material from stores, 200
order of, in closing books, 89
predetermining and distributing factory expense, 202
purchasing and receiving raw materials, 199
Profit and loss statement, 6
analysis of, 399–403
estimated, 382
procedure for analyzing a series of, 403
trend percentage method of analysis of, 400–403
Proprietorship, 8
equation, 8, 9
extension of, 163
single, 163
sole, 165
temporary income, 26
outgo, 26
(*See also* Capital *and* Net worth.)
Purchases, 25
book, 6
discounts, 415
journal, 119–121
problem to illustrate, 121–123
problem to illustrate, 27

R

Ratios, acid test, 387, 388
application of, 388–390
cash to current liabilities, 388, 390
current, 387, 388
deal, 399
sales to inventory, 387, 388
receivable, 387, 388
standard, 395
working capital, 396
Reconciliation, statement, 135, 136
Records, Babylonian, Egyptian, Grecian, Roman, Early English, 1
Italian, 2
Red ink, use of, 92, 93
Reserves (*see also* depreciation).
contingency, 417
Repairs, usually charged to expense, 322

S

Sales, 25
book, 6
discount, 415
journal, 115–117
problem to illustrate, 117–119
manager, 115
manufacturing, cost of, 219–221
problem to illustrate, 27
Selling price, net, 141
Sinking fund, (*see also* Depreciation).
comparison with amortization plan, 286
contribution, 283
payments, 330
Special books, mixed transaction involving, 128
problems to illustrate, 128, 132–134
Specialization, need of, 115
Standard costs, 337
accounting for labor, 354
material, 348
overhead, 355
advantages of, 346, 347
Standard costs, application of, 343–346
applied to shop accounting system, 365–376
bulletin, 340–342
in accounting, 3
practical illustration of, 359
U. S. department of manufacturing plans for, 347–356
use of, 341, 342
Standards, establishing, 338
Statements, financial, 387
profit and loss, 30
reconciliation, 135, 136
Stock, authorized, 167
book value, 167
capital, 166
subscribers, 176
subscription, 176
common, 166
market value, 167
no par value, 168
par value, 167
preferred, 166
real, 167
treasury, 166
unissued, 167
Summary, income and outgo, 31
Surplus, account, 169

T

Taylor, Frederick W., 1, 2, 337
mechanisms, 203
methods, 208
Transactions, analyses of mixed, 22, 23
Treasury stock, (*see also* Stock).
donated, 190
problem to illustrate, 190–192
Trial balance, 34–40
of balances, 34, 35, 47
of sums, 34, 35, 47

V

Valuation, mines, timberland, etc., 329

Value, carrying, 313, 318
  remaining, 320
Voucher, check, 157, 158
  register, 157, 158
  system, 156
    cash discounts on purchases, 159
    evolution of, 156
    extension of, 161
    problem to illustrate, 158–160
    universal, 161

W

Wasting assets, 328
  algebraic expression of, 329
  illustration of, 333
  U. S. Treasury, table of, 331, 332
Westinghouse, 210
Work in process, initial inventory, 219, 220
Work sheet, 62
  problems to illustrate, 62–64, 83–87